TECHNOLOGY DEPT.

Gas Journal

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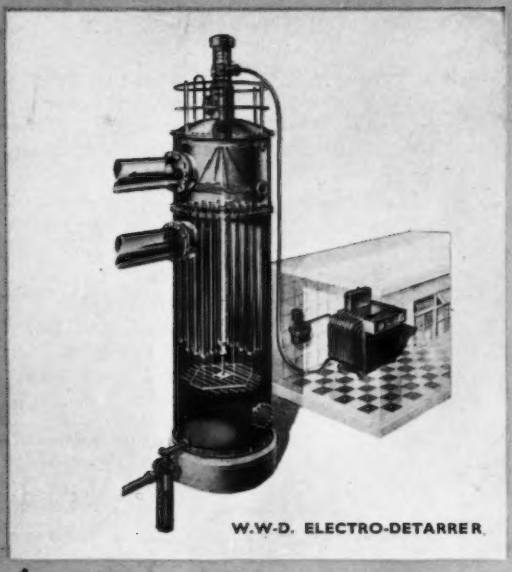
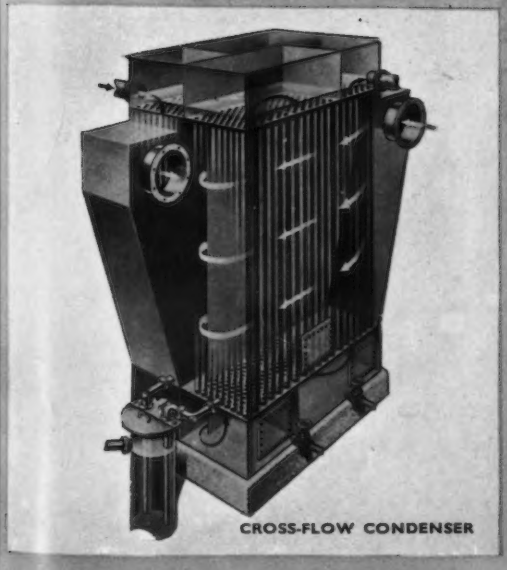
Whessoe design and build COMPLETE ANCILLARY PLANT for the treatment of all fuel gases. Many of these complete purification plants embody CONDENSERS, W.W-D. ELECTRO-DETARRERS and STATIC SCRUBBERS the features of which are illustrated on this page.



W.W-D. ELECTRO-DETARRER



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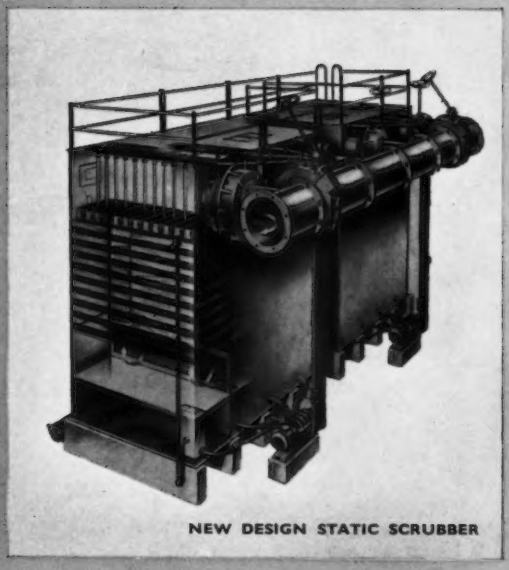

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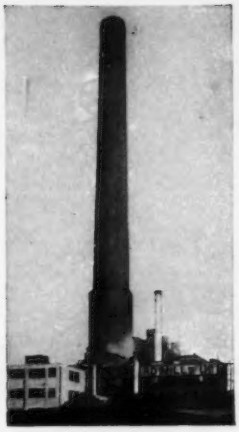
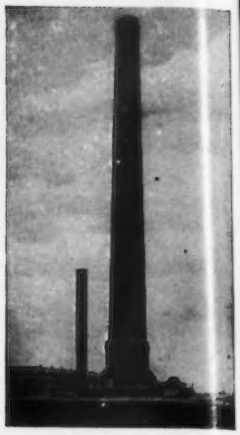
Left : Trial borings for reconstruction of Coventry Cathedral.





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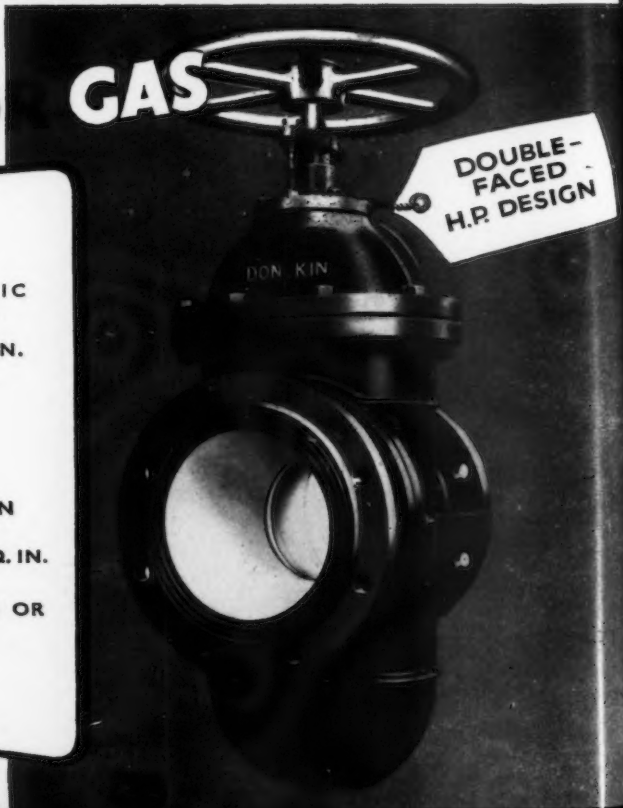

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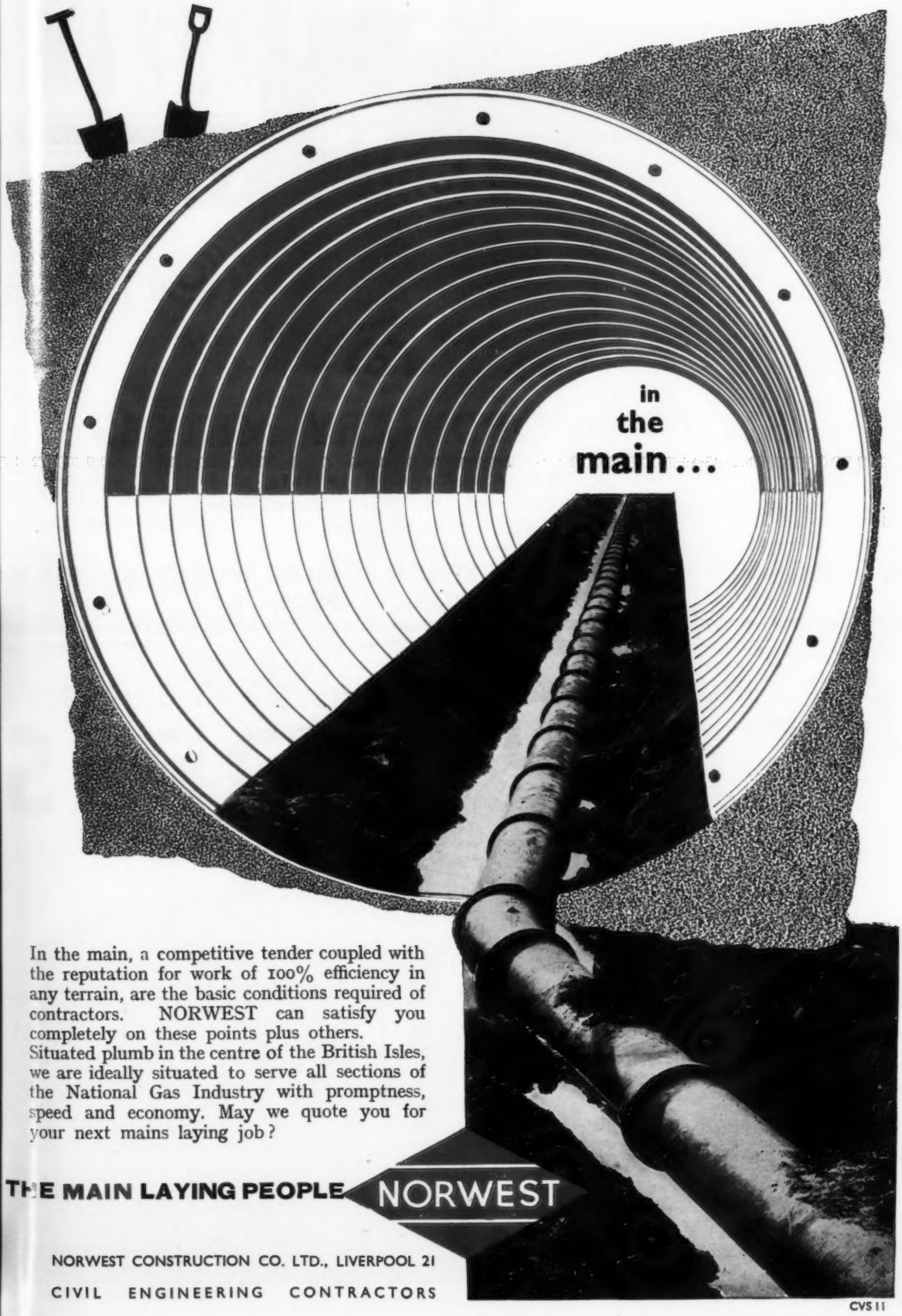

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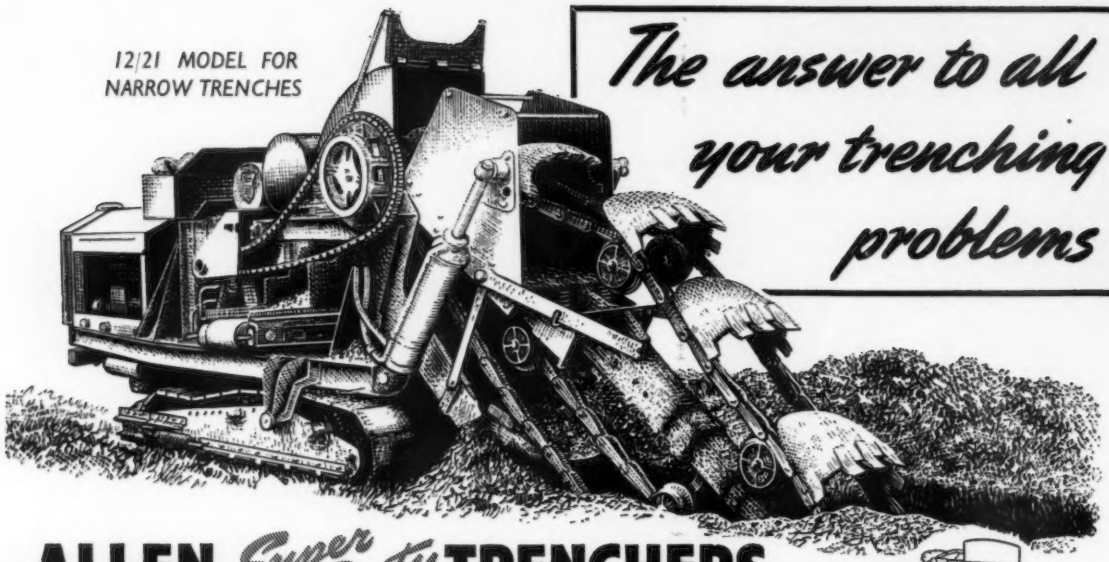

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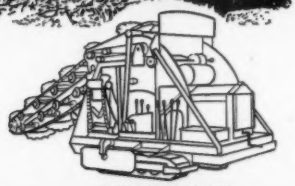

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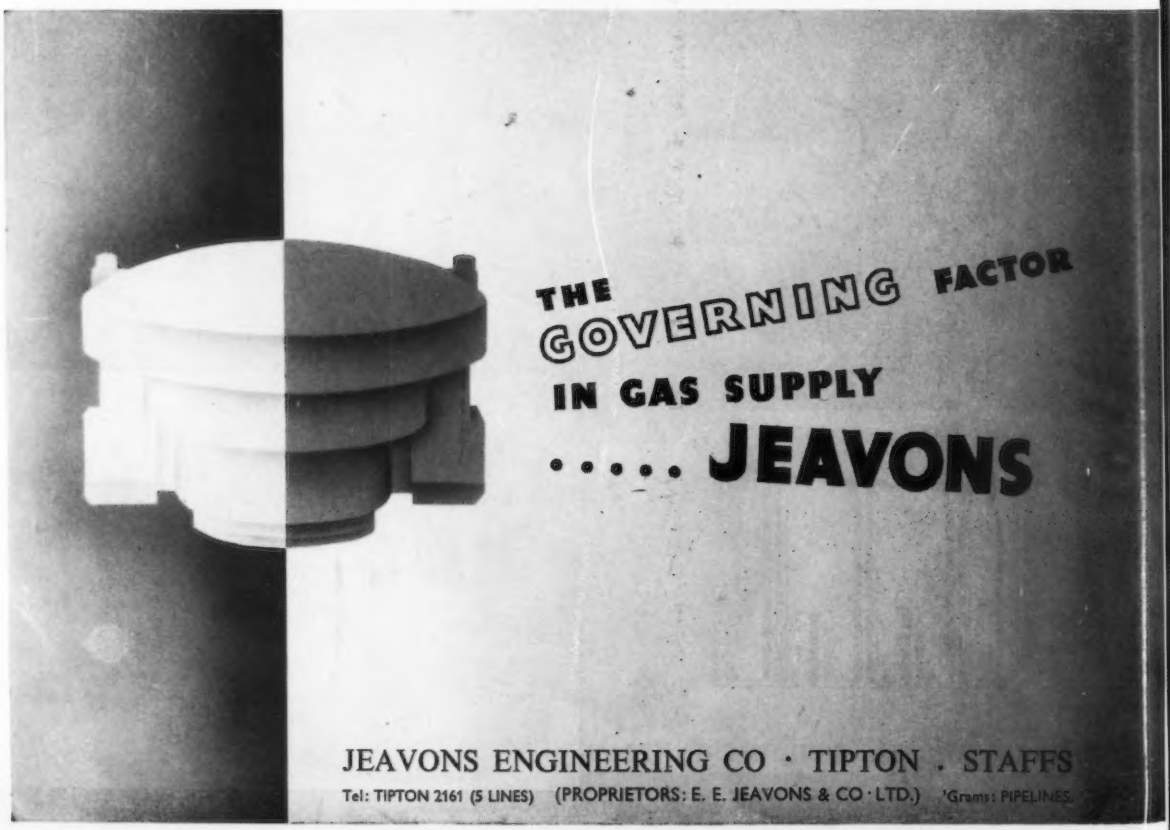

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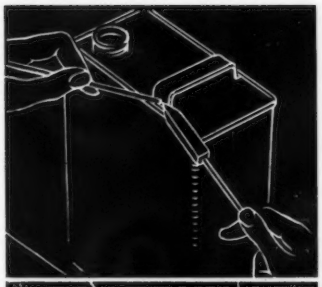

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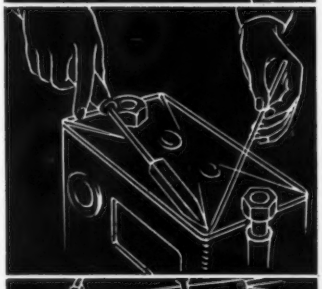

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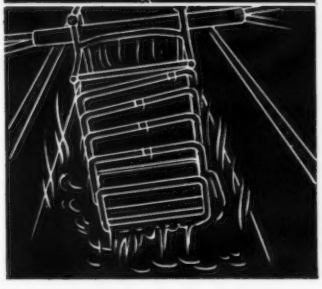

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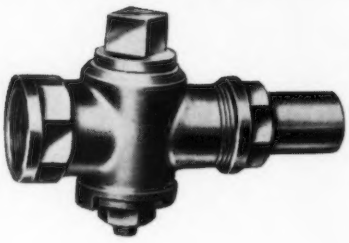

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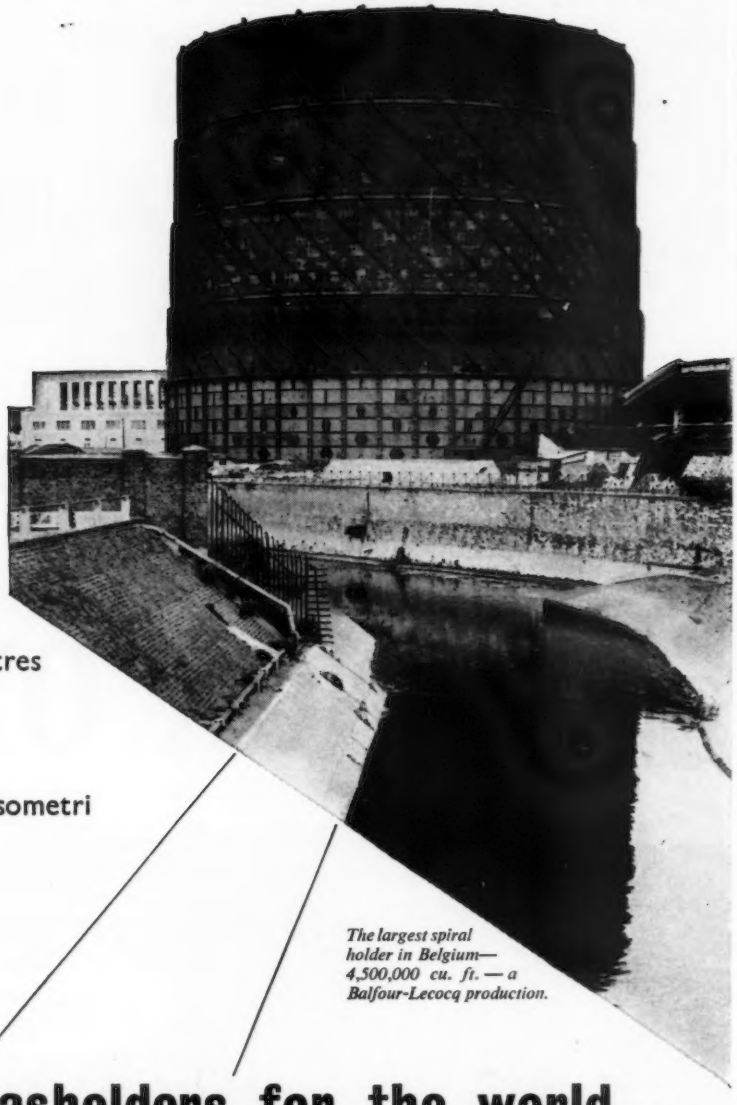

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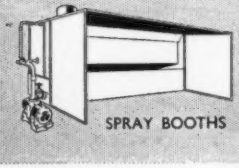

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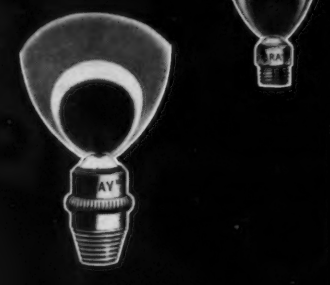

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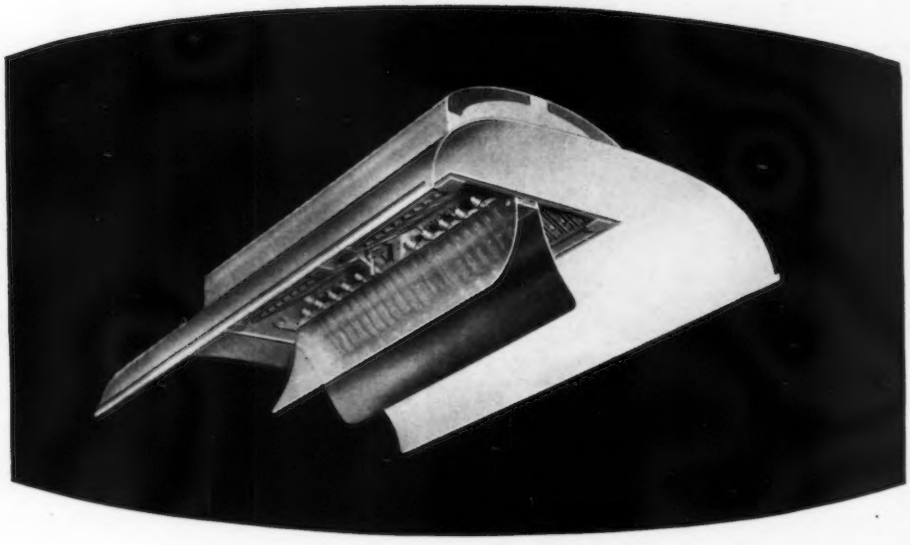

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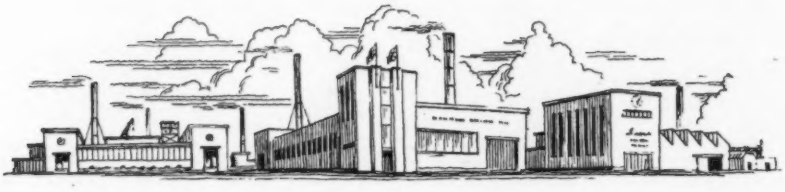

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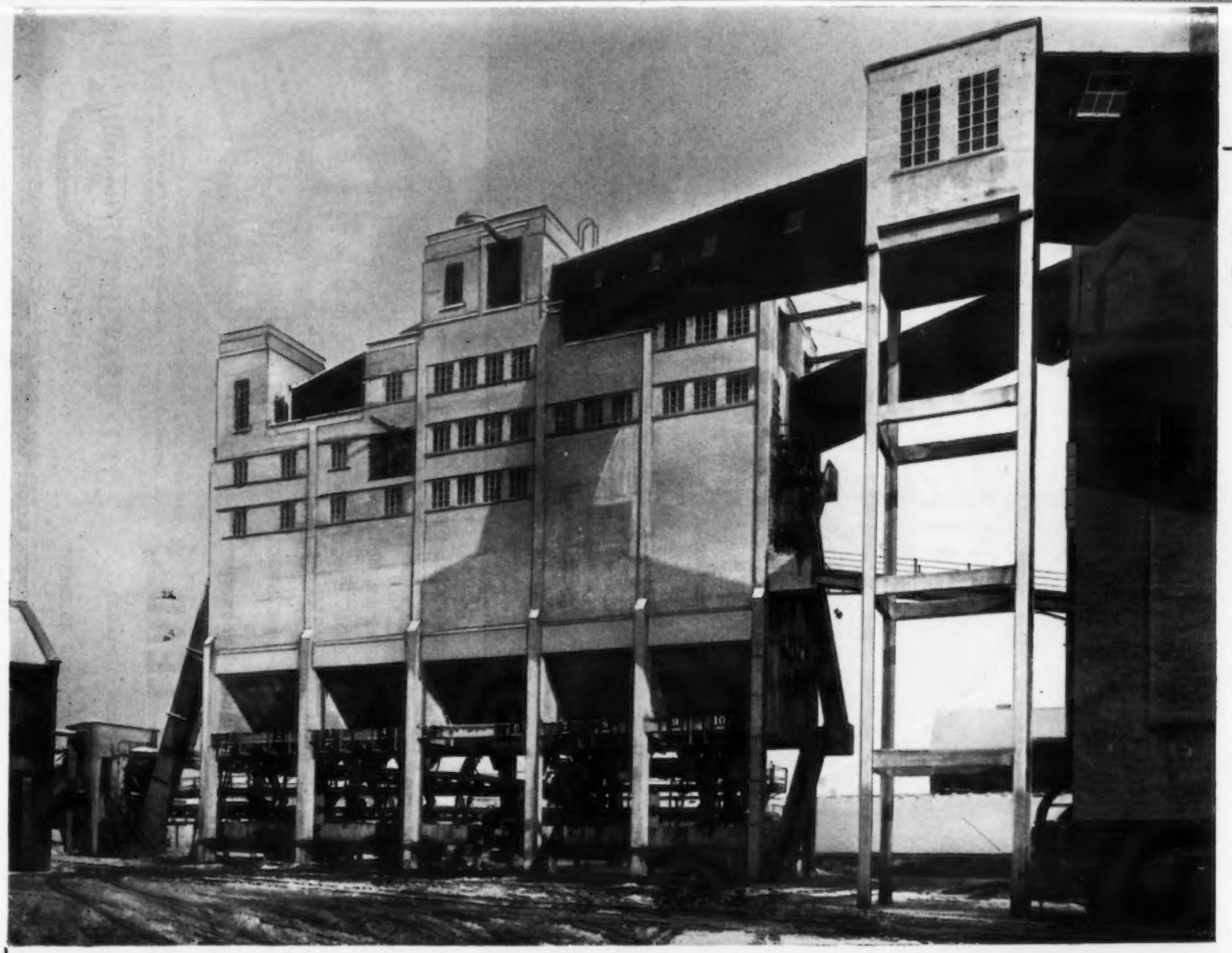

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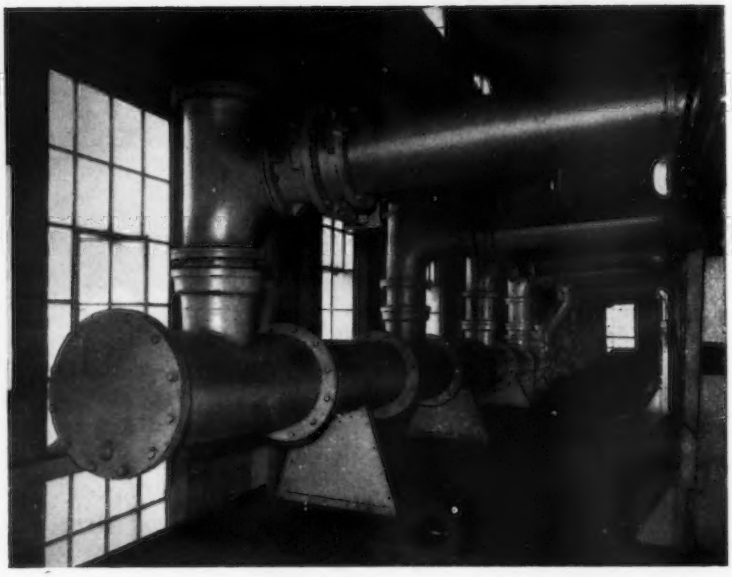

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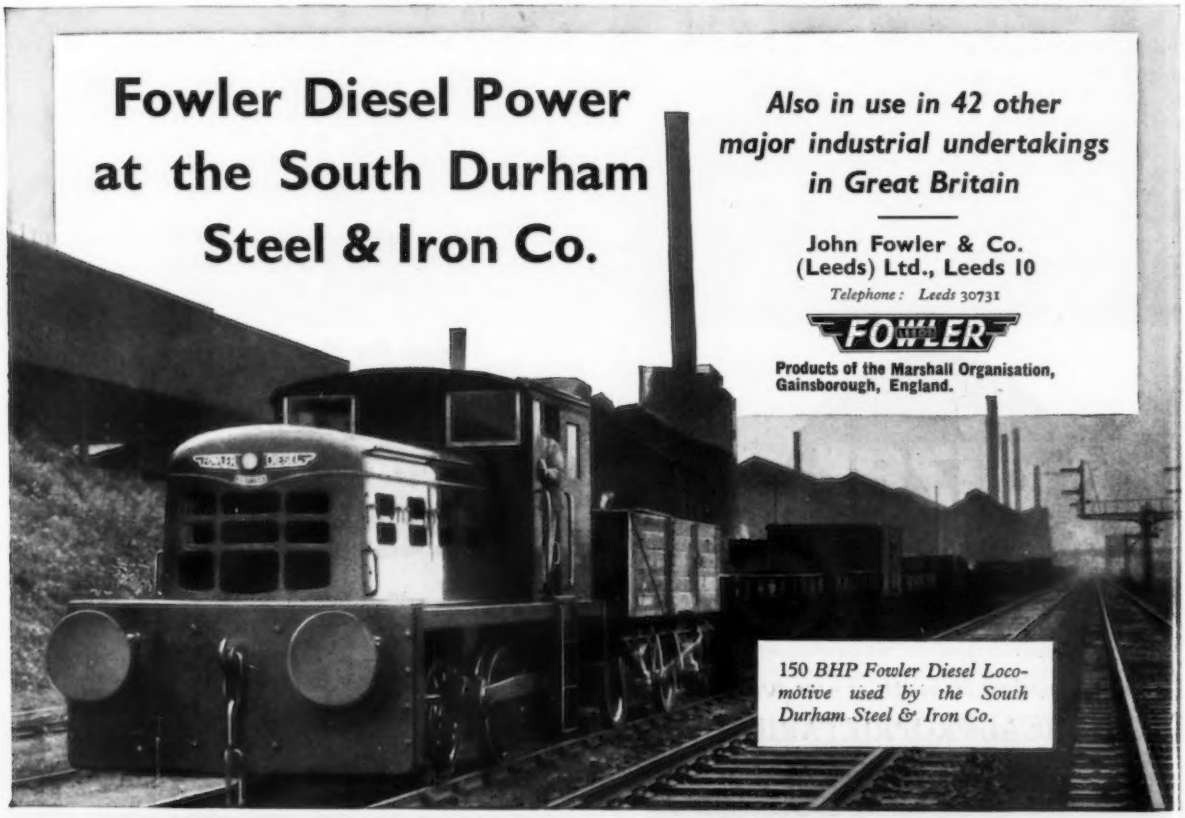

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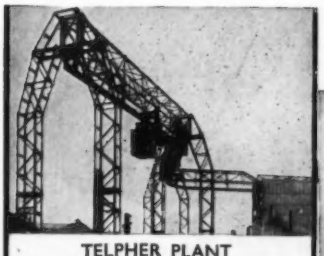

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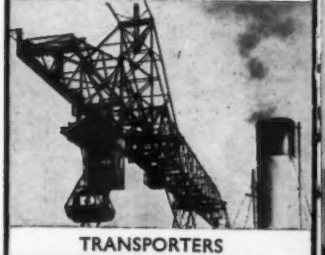

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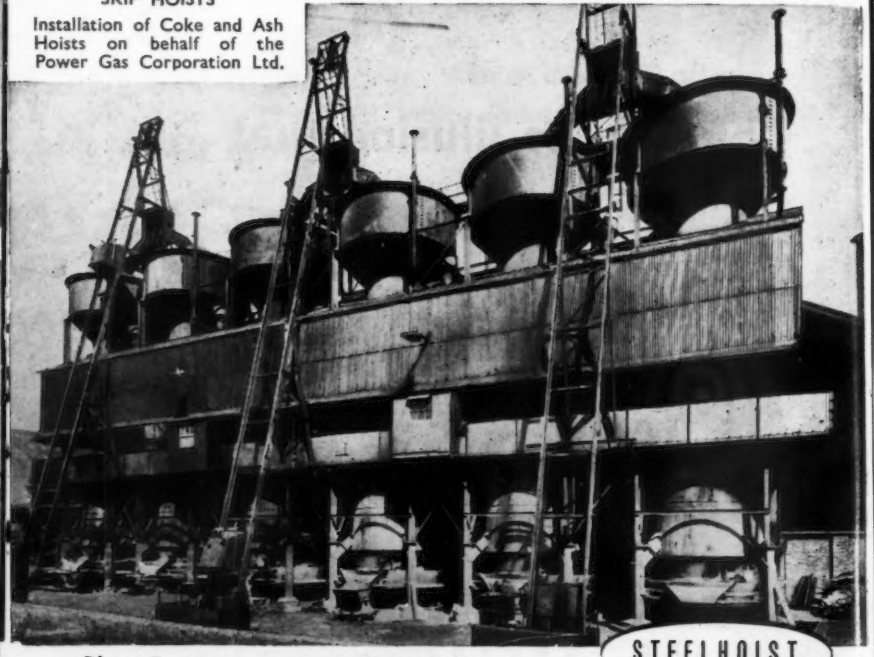

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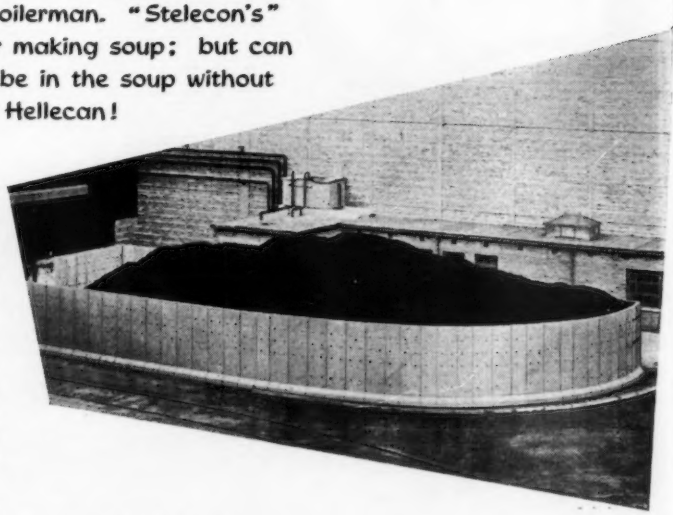

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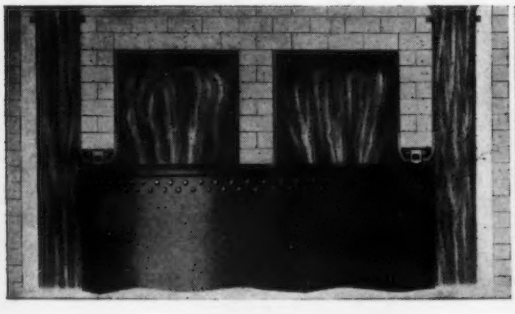

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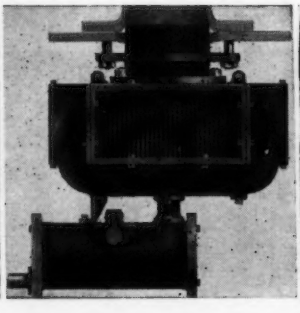

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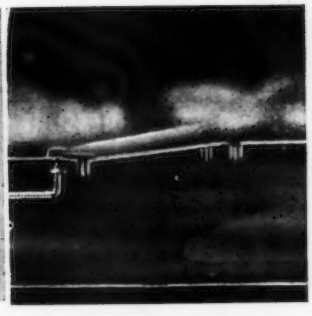

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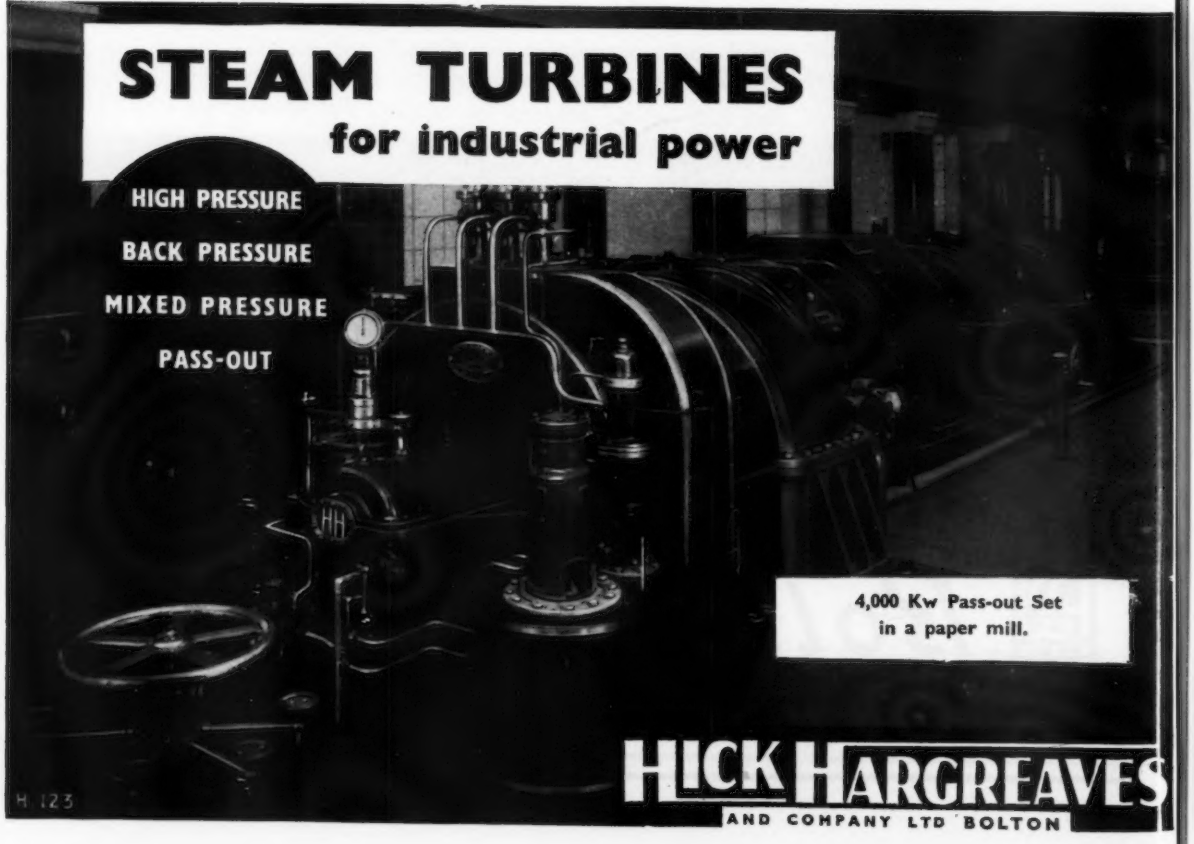

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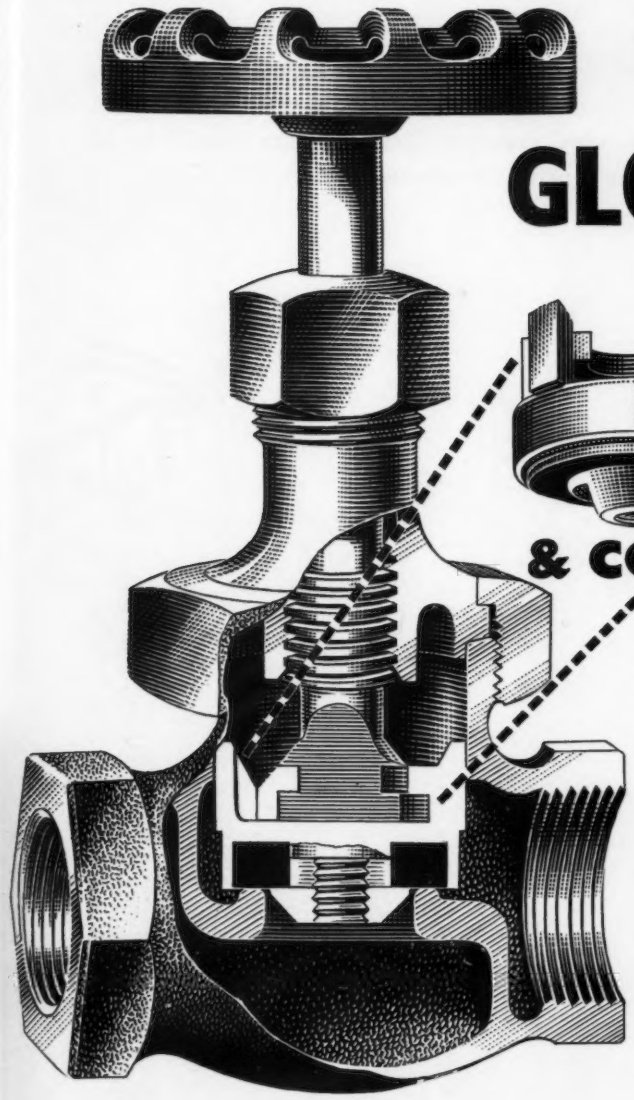

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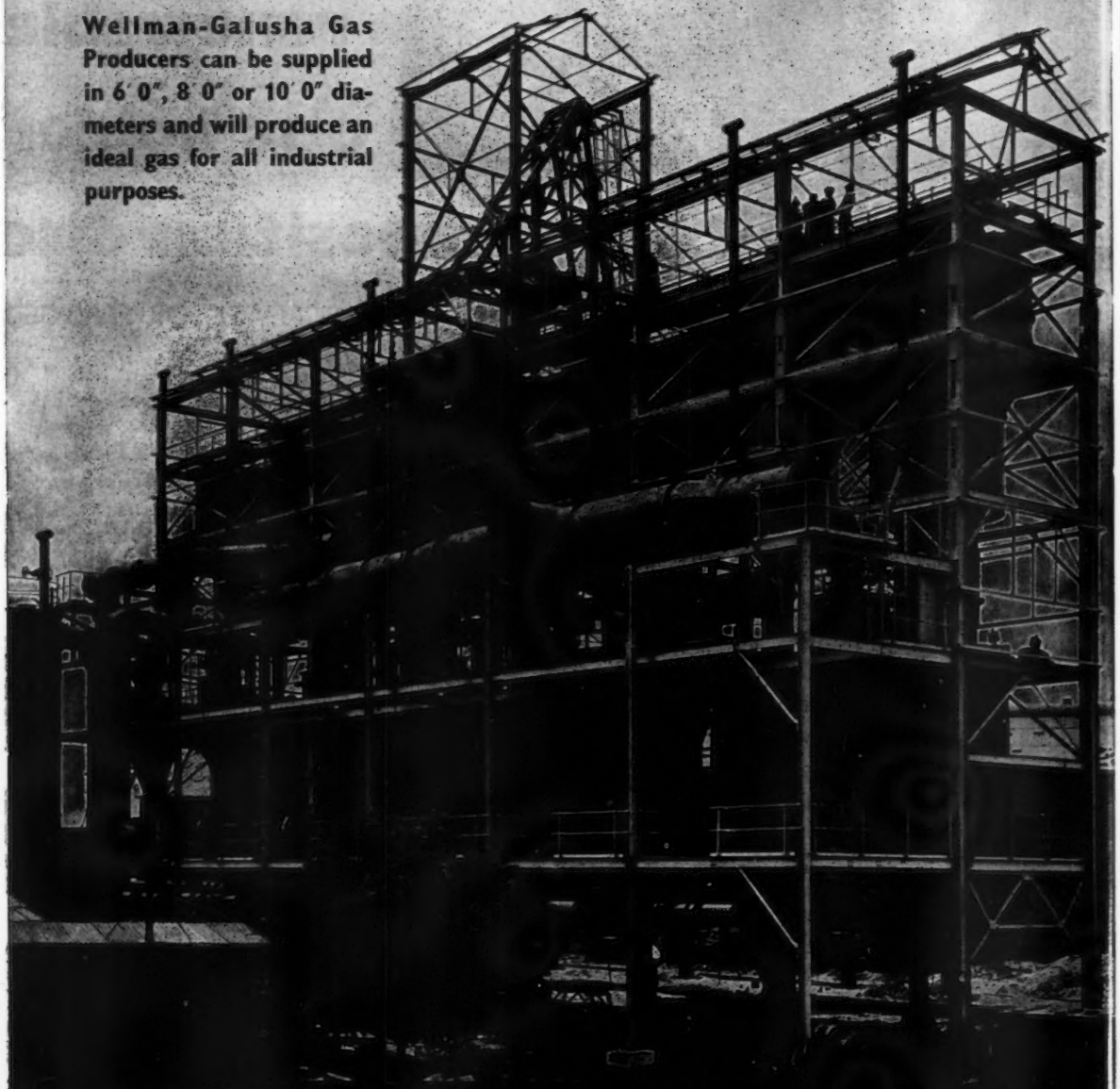

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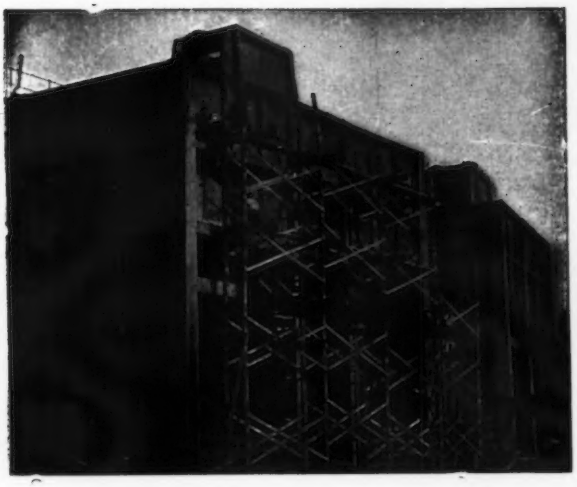

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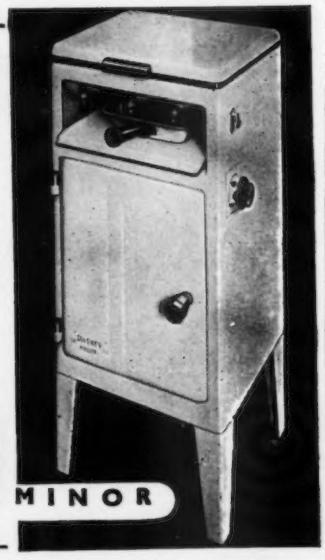

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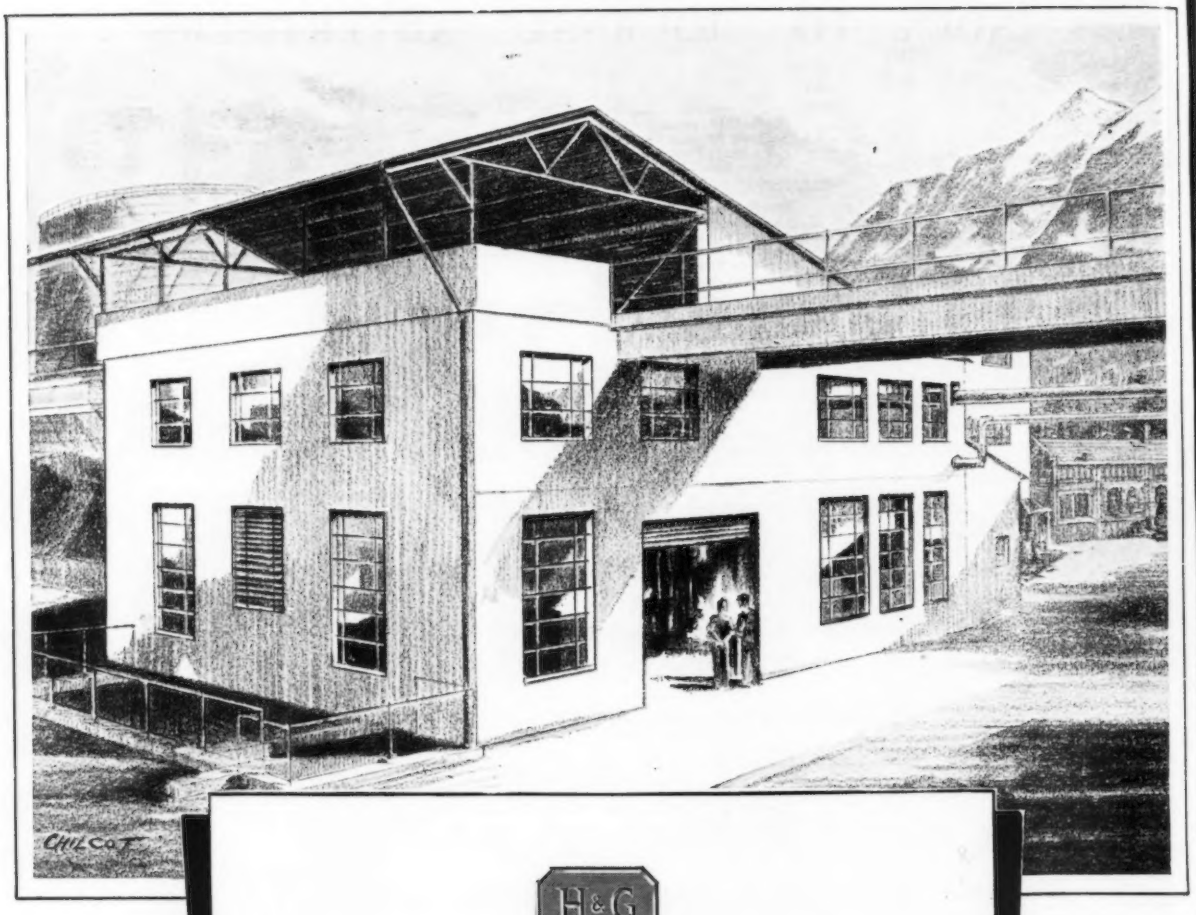

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Gas Journal

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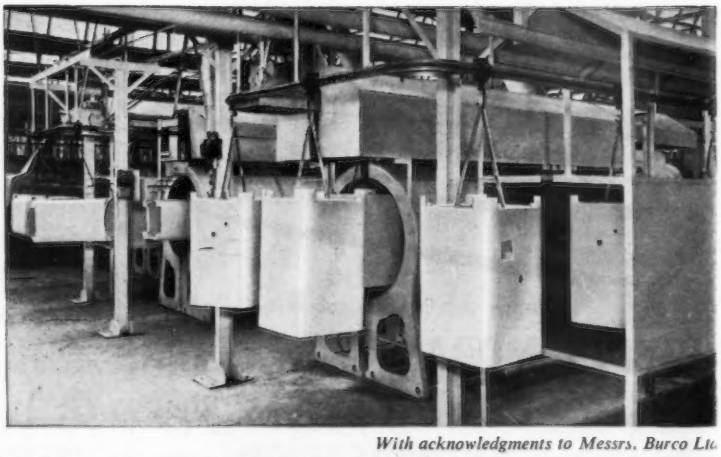

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Gas Journal

VOLUME 281. No. 4788. MARCH 9, 1955. 107th YEAR

The Smokeless City of 1955

IT might be assumed from this title that, before the year is out, some lucky city in Britain is going to see the recommendations of the Beaver Report implemented on a truly colossal scale. This is not quite the case, however, for the city referred to is that of London, which is only part of the County of London, and contrary to popular belief, quite a small area—some 677 acres. Nevertheless, it is one of the most congested in the country, containing many commercial and industrial premises with a very high day-time population. It is extremely encouraging to all those who have 'fought the good fight' against air pollution to know that the heart of the Metropolis is to be freed at last of the malignant growth of smoke and grime from which it has suffered for so many centuries.

On March 3, the Court of Common Council of the City of London decided to invoke the Act of Parliament passed last year, enabling it to declare the City a smokeless zone. This resolution proposes that the regulation shall be enforced from October 2, 1955, and to many this would not seem to allow very much time for the necessary preparations to be made. According to *The Times* of March 4, the power to approve fuels, appliances, and conditions was delegated by the Court to the Corporation's Public Health Committee; it was also stated that 'in addition to coke and anthracite, the authorized fuels will be Welsh dry steam coal, 'Phurnacite,' 'Coalite' and 'Rexco.' The wording of this statement is rather interesting since it infers that coke and anthracite are taken for granted as smokeless fuels, whereas the others are included as additional items. Such official confidence in coke must be fostered if the gas industry is to play its full part in the growing drive against smoke, and the surest way to encourage this is to ensure that the quantities of coke required are available and that the quality is up to standard.

Under the spur of the new smoke ordinance, many firms in the City of London area will no doubt be wanting to change from coal to coke burning in their boilers and furnaces and will present the gas industry, particularly the North Thames Gas Board, with an opportunity to establish a further steady market for its coke.

In the case of industrial-scale plant, the ignitability and reactivity of the coke supplied are not so important, perhaps, as in domestic utilization; nevertheless, these should be as high as possible. What is important to the commercial and industrial user, apart from availability, is consistency of quality which includes not only accurate grading but also a reasonably standard moisture content. Nothing will give coke a bad name more quickly with new users than to find that it is impossible to obtain the supplies they require or, alternatively, that when they do have a delivery, it is soaking wet or badly graded. In this connection, we were interested to watch a delivery of coke being made recently to the cellars of a block of offices in a city that shall be nameless, and it surprised us considerably to note that the size of the fuel varied from well over 3 in. lumps to breeze—and there was plenty of the latter! It is appreciated that this winter has been a hard one and that coke stocks have been severely punished, but it would seem shortsighted that, as in this particular case, a load should be taken straight 'off the floor' and delivered without any attempt at screening or debreezing.

Although everybody connected with the manufacture of gas and coke understands the difficulties with which the gas industry has had to cope during the winter months, the users of these fuels in most cases do not. Their main pre-occupation is that the coke shall burn efficiently in their appliances and with a minimum of labour; as far as they are concerned, it is the gas industry's business to ensure that what is supplied to them does just this.

In an article in the March 2 issue of the *Daily Sketch*, Sir Harold Smith was reported as saying 'if only housewives would use them (coke and gas), the country would be saved 14 to 15 mill. tons of coal a year; and it would also mean clear skies and pure air over our cities; and also that 'we think that one answer to the open fire is a free standing coke appliance such as the openable stove.' Clearly, Sir Harold has in mind the use of both gas *and coke* as smokeless fuels, each in the sphere to which it is best suited and it might be deduced that this implies a readiness and a capacity on the part of the gas industry to supply both as and when required. Already there are unmistakeable signs that the local authorities are 'sold' on the idea of smokeless zones; that in mind for the City of London is but one example, there have been others. As we have said before in these columns, the demand for coke is sure to grow apace as more and more smokeless zones are established and the gas industry needs to plan now to meet the demands of next year and

the year after. Even if the output of coke is limited by coal supplies and the present pattern of the industry's manufacturing processes, nevertheless, there are some aspects of the coke situation that are open to more immediate attention. For instance, grading and cleaning of coke, particularly when taken from ground stock, can be improved and in many cases the moisture content can be more carefully regulated. Above all, it can be recognized by the gas industry that a fair proportion of the coke delivered nowadays leaves much to be desired before it may be considered the ideal solid smokeless fuel. When this fact *is* recognized, then it must follow that the necessary measures to deal with the problem will be taken. Obviously much more screening and hopper storage capacity is going to be required if even larger supplies of coke are to be properly graded and reasonably dry when delivered. In an earlier paragraph of this article we referred to the statement concerning the authorized fuels for the new smokeless area in London. It will be remembered that in this statement coke appeared to have been taken for granted as a suitable smokeless fuel; however, it will not continue to be so if it fails to make the grade!

A Blessing or A Curse?

'THERE is no greater single source of friction or discontent than for an employee to believe that another is being paid more or getting more favourable treatment from the same employer for a similar job.' So said Mr. F. L. Ffoulkes, Industrial Relations Officer, East Midlands Gas Board, when he adressed the recent N.A.L.G.O. week-end school for gas staffs (reported in the 'JOURNAL' of March 2, p. 595). From this statement it would seem that he has set his face towards a fixed salary scale for gas workers. The inability to see both sides of a question, however, is not one of Mr. Ffoulkes' failings, as indeed it cannot be for one in his position. Where equitable treatment is concerned, therefore, he sees in the salary scale a blessing; but he also referred to it as a curse. 'There is the job itself,' he said, 'and there is the individual performing that job. He may be doing it well or poorly; but it is the job which has to be graded and not the individual.'

Here, indeed, is the problem which has belaboured the minds of all those who have at heart the preservation and development of the good management-worker relationship which characterizes the gas industry. If the employee wants more money, says Mr. Ffoulkes, he must be prepared to accept more responsibility. There are plenty of people who want more money and who want more authority; how many of those same people are willing to accept the increased strain of responsibility which goes with it? Although he is not entirely enamoured of salary scales, Mr. Ffoulkes accepts that it is now the grading of the job and not of the individual that counts. Naturally enough, in his talk, he then started to make the best of what he obviously considers an inevitably bad job. He looked at the industry's negotiating machinery, in which he considers we are indeed fortunate. 'Few, if any, industries have better machinery. And everyone in the industry, be he labourer or senior officer, can have the responsibilities of his job examined by the conciliation machinery and can be assured that the award which is finally made, perhaps by an independent body at national level, will be a fair one and will be honoured.'

Mr. Ffoulkes showed his liberality of outlook in his break-down of the negotiating machinery. He dealt first with national and area agreements and the honouring of them. Nearly all agreements are compromises, he maintained, and a cynic would say that a compromise is an agreement unsatisfactory to both sides. But he did not look at it like that. 'When all the talk is over and the agreement is concluded, with each side having given more than it intended to meet the viewpoint of the other, then the onus rests jointly on both parties to see that agreement is honoured and implemented.'

What Mr. Ffoulkes is saying, in other words, is what we believe to be an unfortunate truth: That fixed-scale salaries and wages can be a heavy sheet-anchor to incentive and pride in workmanship. That attractive and ambitious youth, 'Enterprise,' can easily be transformed into the premature old age of stagnation through the security which mediocrity offers; and the industry it affects in this way is left grovelling for lack of high quality manpower. In large, integrated industries, however, the fixed-scale is upon us already and the gas industry must bring out all its powers of resistance against its developing into 'a curse.' It need not be if (1) negotiating machinery is used intelligently and without belligerence, and (2) if what Mr. Ffoulkes calls 'the reputable, mature and competent unions' we are fortunate in dealing with, continue to co-operate with an unbiassed outlook.

REFRACTORY CONCRETE

THE construction of retorts or coke ovens in a refractory concrete cast *in situ* has long been the dream of the carbonizing engineer. Professor Longchambon returned to the use of this material in a paper presented to the Ste des Ingénieurs Civils de France on January 21. He attributes the origination of the idea to Henri Sainte-Claire Deville—the idea to replace the provision of costly special bricks and tiles and their setting by skilled workmen, by an operation of an ordinary industrial character, by concretes prepared and run into position by mechanical means. The suggestion appears to be given a new lease of life by the availability of cements free from impurities. That proposed by Sainte-Claire Deville is an aluminate of lime obtained by the calcining of a very pure limestone with alumina obtained chemically from bauxite. The product contains about 70% alumina to 30% lime with less than 1% impurities—said to be analogous to the Lafarge Ciment-Fondu. The aggregate is chosen to suit the temperature conditions of many industrial heating processes—with corundum, working temperatures may exceed 1,600°C.

It must be noted, however, that when Professor Longchambon was asked whether he would recommend the construction of the coke oven in refractory concrete, he preferred the present material of construction, the silica brick. 'The substitution of concrete with a silica aggregate would be more expensive' he said. 'Silica has its defects, due to its expansion, but these defects are known and a battery of coke ovens is regularly brought up to high temperatures without incidents. That is why I think that, not only for coke ovens but for the

roof of the Martin steel furnace, silica is the best suitable material.' The carbonizer looks longingly at the prospect of the elimination of joints in his retort walls but evidently there would be other troubles, among which would be the difficulty of allowing for expansion.

WHAT'S IN A NAME?

NATIONALISATION brought its share of changes, many of them for the better, but it failed to bring about one reform which we have long thought desirable. This is a careful, broad-minded inquiry by outsiders, into the curiously ill-chosen titles given to people in our industry. Many of the titles are archaic; some are grossly misleading. After all, this industry of ours is public property and the public must be regarded as shareholders who, given a little encouragement, may try to take a reasonable, proprietary interest in our affairs, instead of merely writing stupid, complaining letters to the papers about gasometers, and the smell from the gasworks. A quite substantial part of the population is employed by the gas industry and although these people probably accept without question some eccentric title which has its origins in the days of early gasmaking, there is no reason why they should have to incur the bewilderment, scorn, or baffled silence of their friends who have not the faintest idea what they really *do*.

Supposing a man is a gasworks chemist. How are his friends going to visualize his occupation? Probably as a man in a white coat presiding in some grimy little shop deep in the heart of the works, and kept busy dispensing dressings to stokers, colourful tonics to crane operators who cannot stand heights, and hot water bottles to those duffle-coated stalwarts who man the weighbridges. Or take a fittings superintendent. Ask any person that you chance to meet what a fitting is and ten to one they will say that it is something a tailor gives you in order to convince you that your new suit will clothe you with the distinction that the price had led you to expect. As for a shift superintendent, the inference is even more obvious. And what an unfair and insulting title is that of the showroom attendant! Again ask anyone in the street what his instinctive reaction is to the word 'attendant,' and if he is honest he will no doubt reply that it conjures up a fleeting vision of white tiles. Of course, it may depend on whether you have that kind of mind, but then who hasn't?

Nothing is more confusing today than explaining seniority. For example, there is that curious word 'officer' which somehow implies a uniform. Up in the North East, Mr. Norman Hudson is Chief Commercial *Officer*, and holds sway over a number of sales *managers*. In the North West, Mr. J. W. Rogers is Sales and Service *Officer* and manages a number of subordinate *officers*. In Scotland Mr. R. H. Bone is Commercial and Sales *Officer* controlling, so far as we can gather, nobody at all—unless the distict managers manage as sales officers or officiate as sales managers. In the West Midlands the officer-manager relationship is reversed with the Sales and Service *Manager*, Mr. A. V. Horsfall, looking after his divisional sales and service *officers*. We turn with relief to the quartet of Commercial *Managers* only to find that whereas Mr. H. R. Hart, in the East Midlands, Mr. V. W. Stanton in the South Eastern, and Mr. S. A. King in the Eastern, all control various divisional sales and service *managers*, Mr. S. G. Aberdein in the North Thames does no such thing. In fact he seems to work in the same way as Mr. Bone, keeping tabs on the divisional managers, except that in this case the divisional managers' activities are primarily commercial and thus divorced from those of the engineeers.

Which reminds us that the engineer is rather a confusing character. The man who comes all too often to mend our vacuum cleaner calls himself an engineer, but then so did the man who built Sydney Harbour bridge. It is difficult to think that the two have much in common. Particularly in the old days a gas engineer was also likely to be a manager, and was in fact the centre of gas activity in the town. It seems to us that some new term might be devised, such as 'gas director,' which implies a very proper sense of all-round superiority. And who can deny that on Sir Harold Smith's shoulders the title of 'Gas Director General' would rest with elegance? Exploration along these lines would no doubt reveal other similar titles which would be immediately understandable to the man in the street.

THE GIRBOTOL PROCESS

A RECENT issue of *Chimie et Industrie* carries an article by H. Kristensen on the purification of gases by the ethanolamines as embodied in the Girbotol process and its variants. Originally devised to eliminate CO_2 from natural gas containing helium, it is suggested that this method should be used in France, where ethanolamines are now being produced in considerable quantity at reasonable prices, for the purification of industrial gases, among other things for removal of H_2S from coal gas and water gas. It is claimed that the absorbing power of the ethanolamines for CO_2 and H_2S is greater than that of other alkaline solutions proposed for this purpose, that they are easy to handle and not very volatile so that loss during absorption and regeneration is low, that the process is applied in ordinary conditions of temperature and pressure, that ethanolamines have a high viscosity favouring absorption in dilute solutions, that they are in practice neither dangerous nor toxic, that the apparatus required is simple and can generally be constructed in ordinary steel, and that since regeneration takes place at 100-105°C. steam requirements are low. The process is simple. Impure gas is washed with a solution, which in France is to be of 10 to 30% concentration of ethanolamine, in a simple tower scrubber. The fouled solution is heated by steam in a second tower liberating the impurities which come away in gaseous form. Sulphur can be recovered from the H_2S in the usual Klaus kiln. The solution is then cooled and returned to the absorbing tower, which may need to be cooled by external water sprays because the absorption is accompanied with the evolution of considerable heat. Among the illustrations of the article is a reproduced photograph of a plant erected in this country by the Power Gas Corporation for the Anglo-Iranian Company.

INTERNATIONAL FURNACE EQUIPMENT

Woodall-Duckham Construction Co., Ltd., has acquired from N. Hingley & Sons, Ltd., a financial interest in the International Furnace Equipment Co., Ltd. The Board of that Company has been reconstituted as follows: Colonel P. H. Jones (Chairman) and Mr. P. Jump (representing N. Hingley & Sons, Ltd.); Mr. J. S. Jeffrey and Mr. H. S. Cheetham (representing Woodall-Duckham Construction Co., Ltd.); and Mr. E. D. Copley.

The International Furnace Equipment Co., Ltd., holds the overall exclusive licence to build complete gasification plants and pre-distillation type producers in the British Empire to the designs of the Gas Integrale Group. Woodall-Duckham Construction Co., Ltd., holds the exclusive licence from the International Furnace Equipment Co., Ltd., to sell and construct G.I. complete gasification plants and G.I. producers for the gas industry of Great Britain and other parts of the British Empire. The International Furnace Equipment Co., Ltd., is also well known as designers and builders of furnaces of various types.

Personal Notes

MR. JOHN TATTERSALL HAYNES, General Manager, Western Division, Southern Gas Board, and last year's President of the Institution of Gas Engineers, attended an investiture at Buckingham Palace on March 1, when he was invested by the Queen with the

Order of the British Empire. Mr. Haynes was accompanied by his wife and daughter Miriam. Miss Haynes flew from Cairo, where she works for the Foreign Office, in the Passport Control Depôt, especially for the investiture. Mr. Haynes was awarded the O.B.E. in the New Year honours.

NORTH THAMES APPOINTMENTS

Following the appointment already announced of Mr. A. F. Hetherington to the position of Commercial Manager to the Southern Gas Board, the following appointments have been made by the North Thames Gas Board with effect from March 7: MR. G. H. W. MADGE to be Divisional Manager, Central Division; MR. D. H. ROUSE Divisional Manager, Western Division; MR. P. N. CARPMAEL Manager, Divisional Warehouses; MR. W. D. ELLIS Commercial Assistant to the Divisional Manager, Central Division; MR. L. B. L. HOWLETT Commercial Assistant to the Divisional Manager, Western Division; MR. J. F. DORAN Commercial Assistant to the Divisional Manager, North Western Division; MR. R. M. HILLIARD Service Manager, North Western Division; MR. R. P. RHODES Commercial Assistant to the Divisional Manager, Eastern Division; MR. S. A. TENNANT to be Local Manager, Commercial Districts. Other appointments by North Thames Board with effect from April 1 are MR. E. W. BENNETT to be Deputy Coke Manager, MR. E. H. BADCOCK, Manager, Supply Section of Coke Department, and MR. M. S. KIMBER appointed a Group Buyer in the Board's Buying and Contracts Department.

Changes of title have also been announced by the Board as follows: MR. A. W. LAMOND, Station Engineer, Staines; MR. J. R. OWEN, Station Engineer, High Wycombe; MR. M. H. WESTMACOTT, Station Engineer, Ascot.

MR. F. C. REA, O.B.E., T.D., Portsmouth, has been reappointed by the Minister of Fuel and Power as Chairman of the Southern Gas Consultative Council. The reappointment will date from July 29 when the present term of appointment ends.

MR. K. G. POLAND, of Liphook, Hants, has been appointed by the Minister of Fuel and Power to be a part-time member of the Southern Gas Board. Mr. Poland is head of H. G. Poland, Ltd., Lloyd's Underwriter and Insurance Brokers. He is also a farmer at Liphook.

Correspondence

IDEAL HOME EXHIBITION

DEAR SIR,—In your editorial survey of the Ideal Home Exhibition, 1955, you mention that 'gas has been chosen for the Ideal Kitchen, designed by the Council of Scientific Management in the Home.' This Council is composed only of representatives of women's organizations, and Miss Maywen Godby, who represents the Women's Gas Federation on it, was actually Chairman of the *ad hoc* Committee which designed the kitchen.

This is but one example of the value of having a women's organization which can speak for gas in circles where it would not be possible for the industry to be directly represented.

Yours faithfully,
VERA LAUGHTON MATHEWS,
Chairman,
Women's Gas Federation.
1, Grosvenor Place,
London, S.W.1.
March 4, 1955.

Obituary

FRANCIS B. RICHARDS

We regret to record the death of MR. FRANCIS BARTLETT RICHARDS, M.B.E., M.I.C.E., M.INST.GAS E., former Chairman of Woodall-Duckham, Ltd., which occurred at his home at Cobham, Surrey, on March 6 at the age of 70. After early service with the Bournemouth Gas and Water Company as pupil of Lieut.-Col. H. W. Woodall, Mr. Richards, in 1910, became assistant to Sir Arthur

Duckham and was associated with him in the earliest stages in the development of the Woodall-Duckham continuous vertical retort, on which invention the Woodall-Duckham Company was founded.

During the first world war Mr. Richards acted as Assistant Superintendent of the Government Rolling Mills, Woolston, Hants. After the 1914-18 war the scope of the Woodall-Duckham Companies expanded considerably, and Mr. Richards was appointed a Director in 1923 and Joint Managing Director in 1930. When Sir Arthur Duckham died in 1932 Mr. Richards was appointed Chairman, which position he held for 18 years. After Sir Arthur Duckham's brilliant pioneer work, Mr. Richards did much to consolidate and develop the Company to its present size. His engineering ability, his wisdom, his absolute integrity, and his consideration for others made him a fine leader of men.

He retired from the Chairmanship of Woodall-Duckham Construction Company, Ltd.—the principal operating Company of the Group—at the end of 1949 and from the Chairmanship of the holding Company—Woodall-Duckham, Ltd.—in 1951. He remained a Director of the latter company until his death. Mr. Richards was a past Member of Council of the Institution of Gas Engineers and served on many of its Committees. He was elected an Honorary Member in 1951 and held the Institution Gold and Silver Medals for contributions made to its Transactions. He was also a past Chairman of Council of the Society of British Gas Industries.

Mr. Richards travelled extensively on behalf of Woodall-Duckham and was well known in the gas and coking industries both at home and overseas. He was held in very high esteem by everyone on both sides of the coal carbonizing industry. Mr. Richards will long be remembered by all who had the privilege of serving with him.

MR. W. EAMES CATON, whose death we reported last week, retired from the Oxford and District Gas Company in 1944 and not in 1929 as we implied.

MR. HAROLD WALKER, Manager of the Caistor undertaking of the East Midlands Gas Board, has died at his home at the age of 49. His health began to fail about a year ago, but he had continued at work. Mr. Walker had been in the gas industry since he was 16 years old.

A view of the interior of the acid plant burner house at Tottenham.

By-product Developments at Tottenham*

By H. WADSWORTH, B.SC., A.R.I.C. M.INST.GAS E.

Eastern Gas Board, Tottenham Division

CONSIDERING the difficulties which nowadays often beset us in obtaining chemicals from gasworks products, it surprises me to reflect that 'dim ages ago'—namely, during the first world war—toluene, pure concentrated ammonia and ammonium sulphate were produced in this country generally, and at our own works in particular.

Even at the close of the first world war, the effluent problem existed in so far as our own works was concerned and experiments were carried out by P. C. Gardiner on dephenolation of liquor effluent and the reduction of oxygen absorption by sewage type filters.

With the taking over of smaller works and the general increase in gas sales and production, the whole of the chemical works has undergone steady expansion and the development of each unit is dealt with in separate sections.

Sulphate of Ammonia Plant

The original plant on this site consisted of two identical units each rated at five tons of sulphate per diem, with liming equipment. Only one unit was worked at any one time, as the heat interchangers and the rotary steam tube drier were common to both units. The steam consumption of the stills was approximately 25% of the liquor throughput.

At a later stage, a larger saturator of our own design was erected and had a capacity of 10 tons per diem of sulphate when fed from the two stills together. Later, an extra still was introduced which was capable of feeding the saturator by itself. Some slight improvement in steam consumption was obtained, but this was not of any great significance.

The original steam tube rotary drier was then scrapped and a rotary louvre drier installed. Hot air was used for the drying medium, the air being first heated by steam. This drier was not all that could be desired, partly because of the intermittent nature of the feed.

At the end of the last war, it was decided that a completely new plant should be erected on the same site, but to maintain continuity of production the old plant was first considerably modified. At the same time, it was intended that the modifications should be made with the idea of obtaining the information needed for the design and construction of the new unit.

In the old plant, sulphate magma was ejected from the saturator on to a Monel metal tray and was transferred manually to the centrifuge where it was neutralized with ammonia solution before passing to the drier. After leaving the drier, the sulphate was elevated to an overhead hopper and bagged via a semi-automatic weigher. The first modification carried out was to install a Royston neutralizer, which obviated the use of a tray with its attendant manual handling.

Ammoniacal gases were drawn from the still by a steam ejector and injected into the magma contained in the neutralizer body, the magma being circulated from bottom to top of the vessel by means of a second injector. When neutral, the magma was run into the centrifuge by gravity. After centrifuging, the salt was discharged on to a rubber belt conveyor and thence to a Royston flash drier. It may be interesting, at this point, to describe how an awkward belt feeding problem was overcome.

The sulphate from the centrifuge basket was dropped into a small combined hopper and chute, the chute discharging

* Abstracted from a paper delivered to the London and Southern Section, Institution of Gas Engineers, on February, 15, 1955.

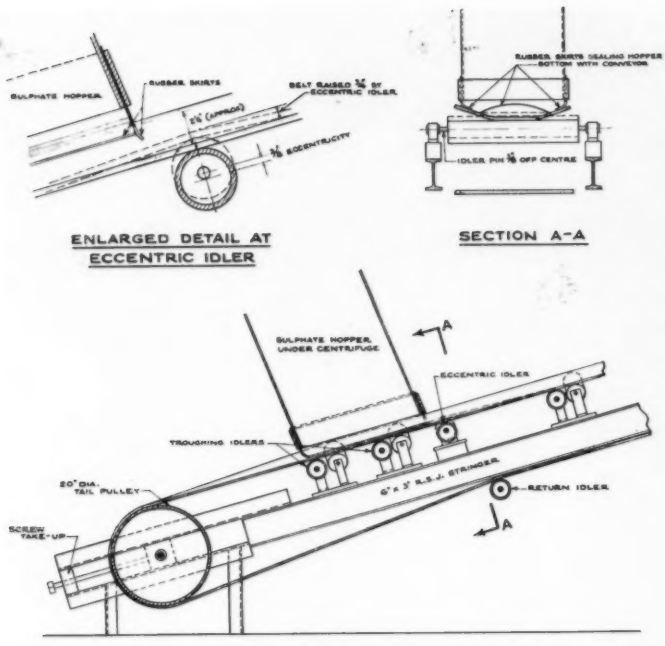

Fig. 1. Detail at tail of 24 in. sulphate conveyor showing discharge from hopper under centrifuge.

directly on to the rubber belt conveyor. A rubber flap was fitted to the end of the chute to aid smooth delivery of the sulphate. It was found that either no sulphate at all was fed to the conveyor, or that an excessive amount was discharged from the chute. If, however, the belt was flexed continuously with a length of wood, feeding was good, and an ingenious method of obtaining this motion was devised by our Chemical Works Engineer, who merely inserted a wooden roller across the belt mounted eccentrically, thus giving a slight up and down motion to the rubber belt and ensuring a perfectly even feed throughout the whole capacity range of the hopper (Figs. 1 and 2).

Returning to the Royston flash drier, the band conveyor discharged into a rotary feeder, where the sulphate was passed into a jet of hot air. The hot air elevated the salt pneumatically up a rubber tube to the top of a louvred chamber down which the sulphate fell. A further volume of hot air was passed up the chamber against the falling salt thus completing the drying.

The dry material fell into an elevated hopper at the outlet of which was a semi-automatic weighing and bagging machine. Any fine dust was removed from the air leaving the drier by causing it to impinge on the surface of water contained in a stainless steel vessel. At the same time, the air changed direction through 180° thus assisting the separation of dust which dissolved in the water. The water solution was then added to the mother liquor used in making up the saturator. A new saturator of our own design was installed to produce 15 tons a day and this figure was closely approached in practice.

The Royston neutralizer worked well but had the disadvantage that the waste gases from it had to be discharged into milk of lime to free them from H_2S derived from the still gases. The time taken for neutralizing also limited the output of this particular plant.

To reduce steam consumption, recycling of the saturator gases through the still was tried for the first time, using a steam injector designed by Messrs. Bell and Roberts, of the British Sulphate of Ammonia Federation (B.S.A.F.) Research Department. More about recycling is given in later pages.

By this time, experience had been obtained to enable us to go ahead with the new unit which will now be described. The main contractors for the plant were George Royston and Sons, Ltd. The still consists of a mild steel shell 8 ft. in diameter lined with Nori inter-locking tiles set in phenol formaldehyde resin. There are 13 trays each carrying eight bubble hoods and these are assembled within the shell by being lowered from the top. The still is fitted with connections for recycling saturator waste gases. No liming arrangements are incorporated in the new plant as liming was not considered an economic proposition.

The still is rated for 3,500 gal. per hour of liquor containing 1.5% free ammonia, producing about 22 tons per diem of sulphate. In practice, concentrated liquor from our own works and purchased outside the Division increases the liquor strength to 3% or so.

The saturator is 7 ft. 6 in. diameter, tile lined and resin bonded, with side entry cracker pipes fitted with ceramic jets (Fig. 3). The magma is ejected into a cylindrical collecting vessel of stainless steel also lined with Nori tiles and set in P.F. resin. The capacity of this vessel is such as to just fill the centrifuge basket to which the magma runs by gravity.

The centrifuge is of the vertical type with a stainless steel basket and monitor case, the speed of rotation being controlled by a Carter infinitely variable gear. The Carter gear is a positive displacement type of hydraulic infinitely-variable-speed gear which maintains constant torque over the entire speed range. After centrifuging the sulphate is discharged by a plough on to a rubber band conveyor and thence to a Royston drier.

Gases from the saturator are recycled back through the still by means of a steam injector before finally passing to the heat interchangers. The heat interchangers have stainless steel tubes and headers, the gases passing through the tubes.

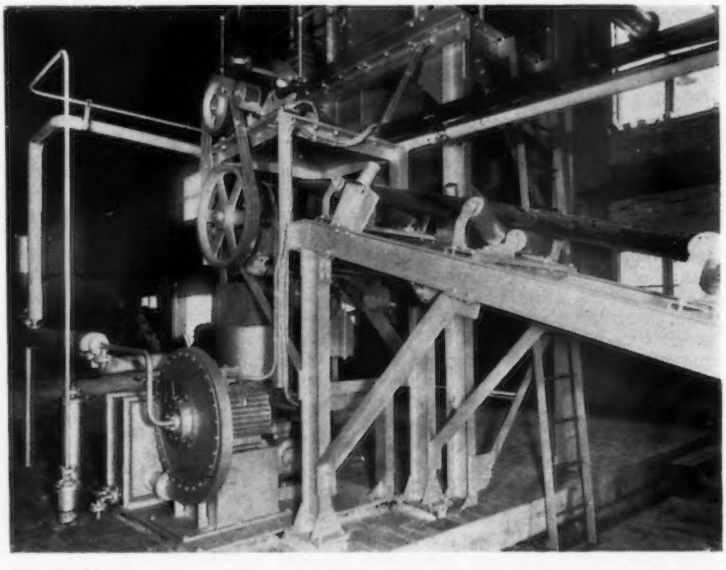

Fig. 2. Close-up view of Royston 'flash' drier showing feed conveyor discharge into blowing pot.

The operating platform and centrifuge stage are of Nori brick P.F. resin bonded and are supported on a steel structure which was flame cleaned and painted before putting the plant to work. The floor of the house, immediately under the staging and round the saturator, is of Nori brick set in P.F. resin; the rest of the floor is of Nori brick set in a proprietary bitumen base product.

The old plant after modification did produce a considerable proportion of Grade 1 sulphate but owing to the pressure

ut on producers to make Grade 1 entirely, the new plant as designed and guaranteed to produce this grade exclusively. his it has done from the first day of working.

Apart from the financial advantage in producing Grade 1 lt, many other advantages result from making good crystals. hen producing Grade 1 sulphate it is possible, easily, to entrifuge the magma to a moisture content of about 1%; simple water wash reduces acidity almost to zero, enabling small ammonia gas bleed at the drier to give a completely eutral salt. General saturator conditions when making good rystals do of course help in keeping the acidity of the magma

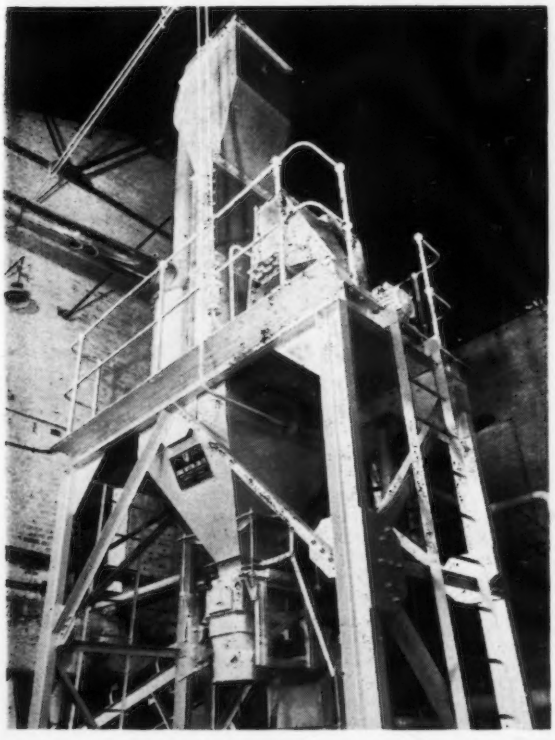

Fig. 3. Close-up view of Royston 'flash' drier showing discharge point.

low and the mother liquor in the saturator is therefore kept at an acidity of 2½ to 4% H_2SO_4.

The sulphuric acid supplied from our acid plant is suitable for making Grade 1 sulphate without any additional chemical control in the saturator, but the addition of a small amount of sodium oxalate gives an improvement in the shape of the crystal, and length to breadth ratios of between 2 to 1 and 4 to 1 are normally obtained. The amount of oxalate used is about 1 lb. per ton of sulphate made. The use of oxalic acid and oxalates was an I.C.I. patent, the English rights of which were held by the B.S.A.F. The final drying is also considerably improved and a normal moisture content of not more than 0.04% H_2O is obtained. (The specification requires not more than 0.2% H_2O.)

The production of Grade 1 sulphate at a high rate of output from the saturator means that a high solids content must be maintained in order that the crystal has the requisite time for growth. It is thus essential that the magma is kept well agitated to avoid settlement and the formation of rock salt. To maintain this agitation by means of steam and still gases alone when distilling liquor of about 1.6% free ammonia and over, results in a consumption of steam greatly in excess of the theoretical amount necessary for the process. Recycling of saturator waste gases back through the still to the saturator provides the requisite volume of gas to ensure sufficient agitation and gives a considerable reduction in steam requirements since this is achieved by means of a steam injector, the driving steam of which, mixed with the inhaled gases, provides the heat for the still. Besides providing this essential agitation, a large proportion of the heat of reaction in the saturator is transferred direct to the still, thus reducing the load on the heat interchangers.

Effluent Disposal

Effluent is discharged from the plant into pits which were originally used for settling out lime sludge. This enables sufficient cooling time to be given before pumping into the local council's sewer. The council accepts the effluent under an agreement which limits temperature, rate of flow, oxygen absorption, etc. In this connection a Lee type recording flow-meter has had to be installed. The effluent is pumped into the stilling section of the meter and flows through this to the sewer by gravity.

Sulphuric Acid Plant

Before describing the sulphuric acid plant in detail a brief account of the chamber process will be given. Fundamentally the reaction required is:—

$$SO_2 + \tfrac{1}{2} O_2 \rightleftharpoons SO_3$$

The addition of water produces H_2SO_4.

This reaction only proceeds in reasonable time in the presence of a catalyst, in this process, oxides of nitrogen. For the sake of simplicity the following equations can be said to show the catalytic action of these oxides:—

$$2\,NO + O_2 = 2\,NO_2 \quad \text{(slow)}$$
$$NO_2 + NO = N_2O_3 \quad \text{(immediate)}$$
$$N_2O_3 + SO_2 = SO_3 + 2\,NO \quad \text{(immediate)}$$

Spent oxide is burnt with excess air to give sulphur dioxide. The sulphur dioxide and oxygen from the excess air are then mixed with nitrous gases and passed to large lead chambers where they meet fine sprays of water. The chambers are large enough to give time for the reactions to proceed to completion and for the heat of reaction to be dissipated. The exit gases from the chambers therefore contain oxygen, nitrogen, and oxides of nitrogen.

It is clear that theoretically there is no loss of nitrous gases and that they may be used over and over again if they can be recovered. The method of recovery is by the absorption of the nitrous gases from the chambers in cold sulphuric acid of at least 77% strength. This is accomplished in Gay Lussac towers, usually two or more in series, the gases going up the towers counter current to the acid. The acid leaving the first tower is termed semi-nitrous vitriol and after this acid has been passed down the second tower it is known as nitrous vitriol. The nitrous vitriol has now to be induced to give up its oxides of nitrogen to catalyse fresh burner gases. This is accomplished by passing the nitrous vitriol down a lead tower (Glover tower), lined with acid resisting brick and packed with rings. Down this tower is also passed weak acid (66%) produced in the chambers, and the mere fact of dilution tends to liberate some of the oxides of nitrogen from the nitrous vitriol. Up the tower are passed the hot gases from the spent oxide burners at about 500°C., and these complete the liberation of oxides of nitrogen, at the same time concentrating the weak acid of 66% strength to the desired strength of 77%. The strong acid leaves the tower at about 150°C. and is cooled, some then being pumped over the second Gay Lussac tower and the rest going to storage.

There is, of course, in practice a small loss of nitrous oxides from the final exit, and this loss has to be made good.

The modern method of replacing the lost nitrous gases is as follows. Pure ammonia liquor of 25% strength is distilled to drive off ammonia gas which is mixed with air in the correct proportions and passed over a hot platinum gauze. After preliminary heating up of the gauze, the reaction is self-supporting and the ammonia is completely oxidized to oxides of nitrogen. Fig. 4 shows diagrammatically the flow of gases and the acid circulating systems.

Original Plant

The original plant producing 80 tons per week of 77% acid consisted of three chambers, each of 30,000 cu.ft. capacity, 50 ft. long, 20 ft. wide, and 30 ft. high, fed with gases produced by four Carmichael mechanical burners each capable of burning about 1½ cwt. per hour of spent oxide (title block). These burners consist essentially of two refractory hearths, one above the other. The crushed spent oxide is fed through a rotary valve on to the top bed, and a continuous chain, carrying rakes, draws the burning oxide along the bed over the end where it falls on to the lower bed and the returning chain carries the oxide to the front of the burner and discharges

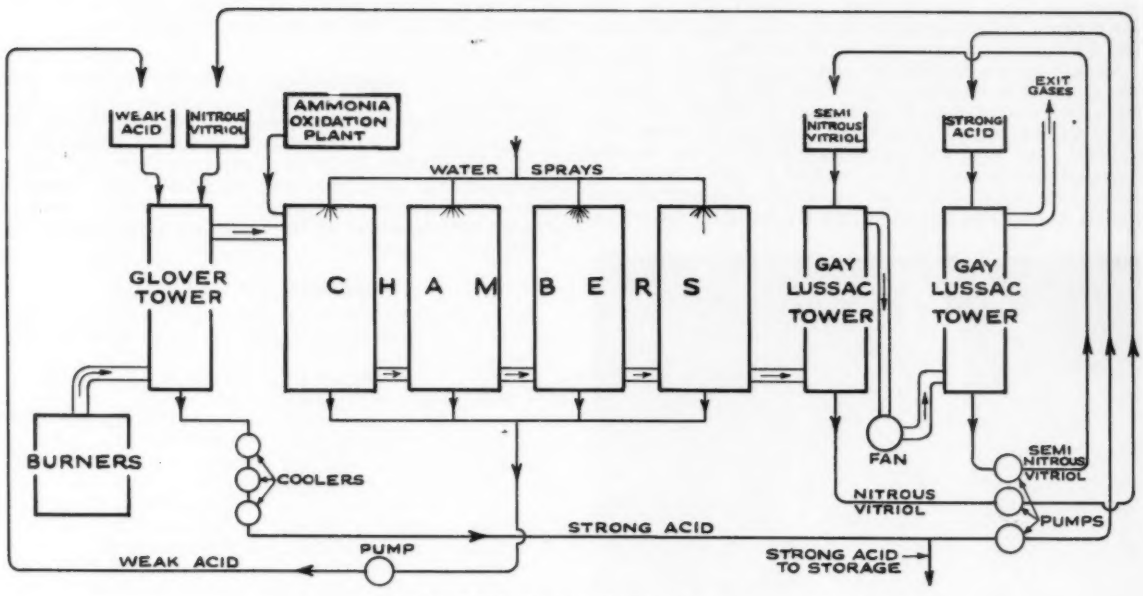

Fig. 4. Sulphuric acid chamber process.

it fully burnt into bins which were, until recently, emptied manually. The burner gases pass through a down flue and circulate under the hearths in a labyrinth flue before rising to a collecting flue. The purpose of these flues is to deposit dust by constant change of direction of the gases.

The original acid pumps were of the Ferraris type. Between the acid and plunger was a buffer of inert oil preventing contact of acid with the machined surfaces of the piston and cylinder. These pumps were very efficient and trouble free. The Glover tower was of conventional design and ring packed. The Gay Lussac towers were installed by J. F. Carmichael & Co., and consisted of lead towers lined with acid resisting brick and packed with glass slats on edge to give maximum wetted surface. In 1939 a further two burners were added together with an extra chamber. These additions provided an increase in throughput to 120 tons of 77% acid per week. In 1947 a larger Glover tower was installed and the output was forced to its limit, which proved to be 140 tons per week. The Gay Lussac towers, originally put in to deal with 80 tons per week, were then doing a 75% overload quite satisfactorily, which speaks well for this design.

Modernization and Enlargement of Plant

The increasing output of sulphate of ammonia made it necessary to enlarge the plant, and it was decided to double the capacity and at the same time modernize the whole plant by avoiding manual labour wherever possible. Apart from a few days taken in completing final connections no production time was lost in the change-over.

The four chambers were doubled in size, one at a time, and while this was taking place a new pump room was built which also housed acid coolers of our own design and make. The larger quantities of acid to be circulated precluded the use of Ferraris pumps, and centrifugal pumps made by La Bour were installed. The old pump house was then demolished to enable extensions to the burner house to be made.

An additional six burners were built together with a connecting flue to a new Glover tower. The new flues were designed to give several changes in direction to increase dust deposition and great attention was paid to the provision of easy cleaning facilities. The extremely clean acid obtained has proved the value of these efforts.

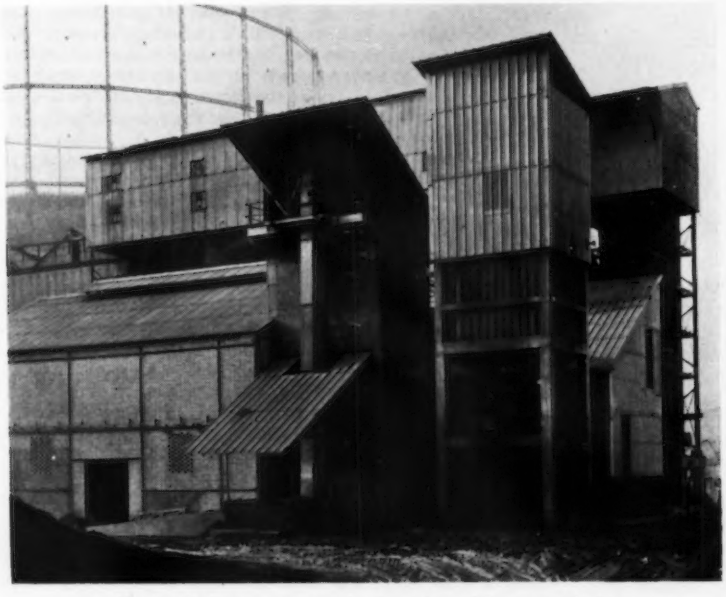

Fig. 5. Acid plant—spent oxide elevator and burnt oxide hopper.

Up to this time spent oxide had been led to an elevator by hand and it was decided to mechanize this operation. Spent oxide is either tipped direct from a lorry or fed by a mobile crane from the adjacent storage heap into a concrete hopper. (Fig. 5.) An elevator is fed from the outlet of the hopper by a Locker vibrating feeder and is discharged on to a bar screen. The fines pass through the screen direct into a concrete storage hopper and the lumps over ¼ in. are fed into a Crone and Taylor disintegrator before discharge to the same hopper. The crushed oxide is then fed as required to the burners via a vibrating feeder and drag link conveyor. The hopper contains about 1½ days supply of oxide.

Removal of burnt oxide residues was a difficult problem owing to the fineness of the bulk of the material, and the temperature of discharge (400°C.). The following typical screening test of the dust gives an indication of the problem:—

Above 422 microns	= 26.2%
422 microns to 53 microns	= 52.9%
53 ,, ,, 6.6 ,, ...	= 17.4%
Below 6.6 microns	= 3.5%

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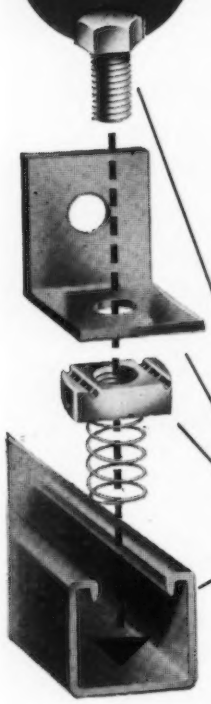
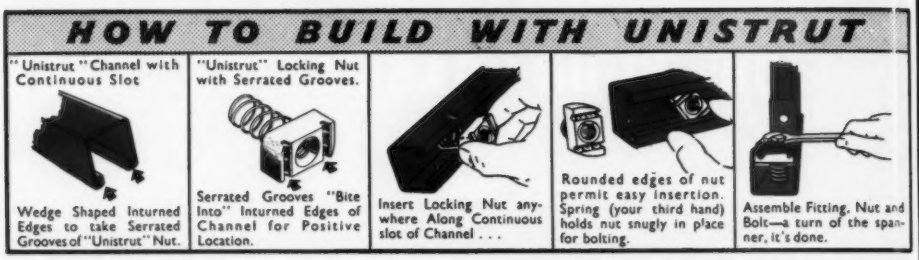


HOW TO BUILD WITH UNISTRUT


"Unistrut" Channel with Continuous Slot
Wedge Shaped Inturned Edges to take Serrated Grooves of "Unistrut" Nut.
"Unistrut" Locking Nut with Serrated Grooves.
Serrated Grooves "Bite Into" Inturned Edges of Channel for Positive Location.
Insert Locking Nut anywhere Along Continuous slot of Channel . . .
Rounded edges of nut permit easy insertion. Spring (your third hand) holds nut snugly in place for bolting.
Assemble Fitting, Nut and Bolt—a turn of the spanner, it's done.

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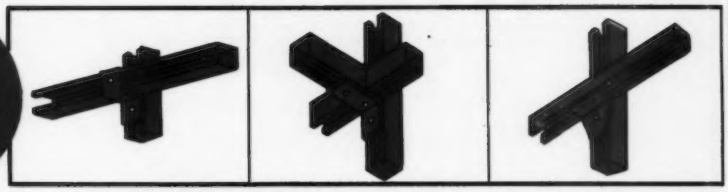

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Unistrut Bolt
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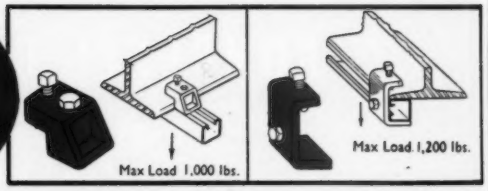

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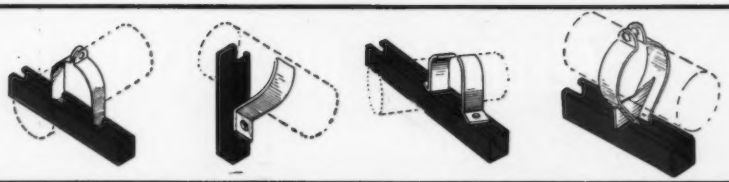
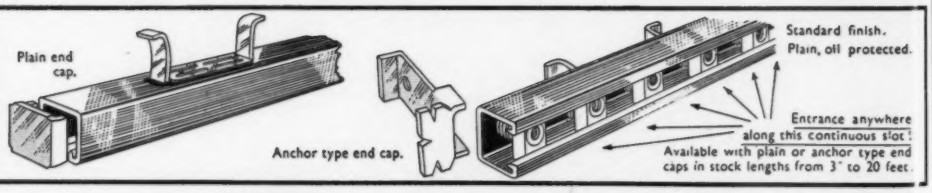


CONCRETE INSERTS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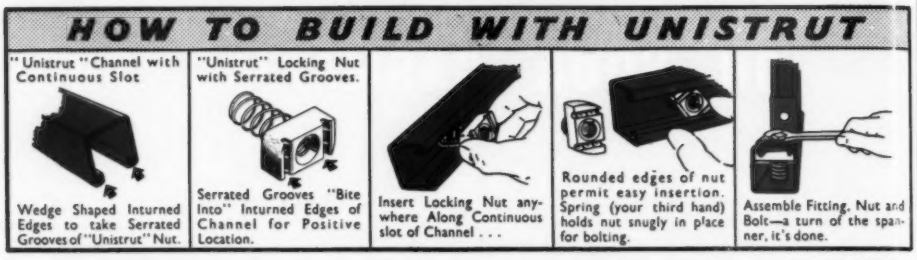
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Assemble Fitting, Nut and Bolt—a turn of the spanner, it's done.

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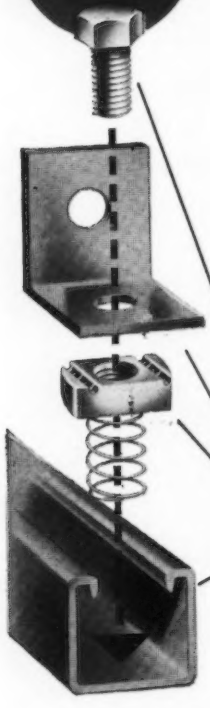

THE BASIC COMPONENTS

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Unistrut Locking Nut.

Unistrut Channel 12 gauge 10'-0" and 20'-0" standard lengths.

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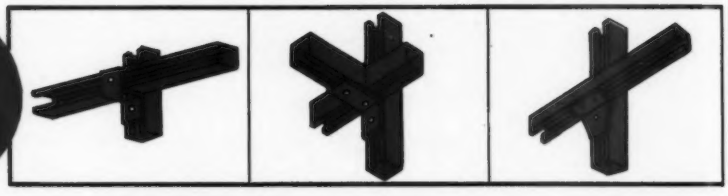

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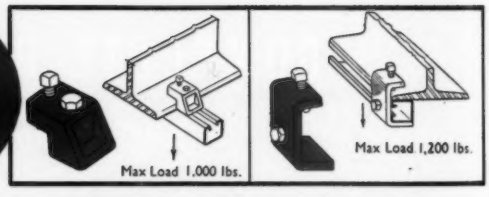
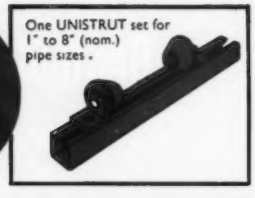


ROLLER PIPE SUPPORTS



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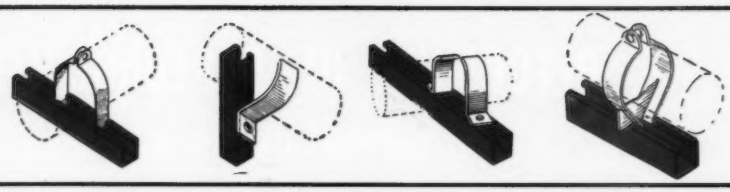

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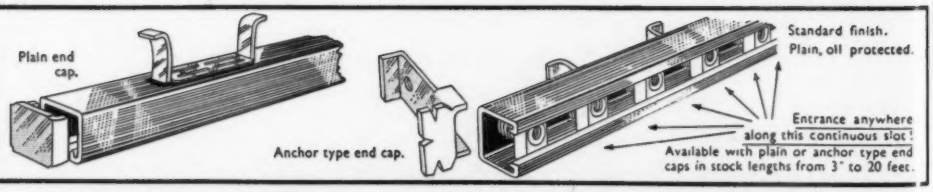
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The logical solution of the problem was to use pneumatic means for the collection and disposal of the dust and, in conjunction with Simon Handling Engineers, a plant was designed in which the residues are collected in small hoppers, one fitted to each burner. The dust is removed from here pneumatically at intervals and conveyed in the air stream up to a settling chamber where the larger particles separate out. The remaining dust then passes through a high efficiency cyclone which removes the bulk of the material and the finest particles left in the air stream are passed through a Peabody scrubber where they are washed out with water, leaving clean dust-free air to pass through the exhauster to atmosphere via a Burgess silencer.

The whole of the burnt oxide dust is collected in an overhead hopper of reinforced concrete and of 30 tons capacity, taking four to five days supply. A Babcock wetting conveyor handles the dry burnt oxide dust from the hopper and delivers it to a lorry at the required moisture content.

The new Glover tower, erected by J. F. Carmichael & Co., is 12 ft. in external diameter and is packed with acid resisting rings. To facilitate cleaning the Glover inlet main, a permanent staging is provided. To deal with the increased output of the plant the two old Gay Lussac towers were put in parallel and a new tower erected to operate in series with them. The new tower is approximately 8 ft. square in section and contains four square sections each carrying glass slats on edge, as in the earlier towers. A new draught or booster fan was installed between the two sets of towers. The ammonia oxidation plant was also renewed to deal with the extra output.

The acid coolers are of our own design and have proved very satisfactory both as regards efficiency of cooling and ease of cleaning. They are fabricated in lead and all lead surfaces in contact with acid are arranged to be cooled on the opposite face by water.

Benzole Refining Plant

The original unit consisted of a small batch still with a ring-packed column suitable only for the production of motor benzole. The whole of the crude benzole was given a light acid wash in a small Typhoon washer of 1,000 gal. capacity and after distillation and the addition of a gum inhibitor, the product conformed to the motor benzole specification of the National Benzole Co., Ltd.

As a result of increased crude benzole production at our gasworks, two more batch stills of larger size with ring packed columns were erected together with a Typhoon washer of 3,000 gal. capacity. The stills were of 3,000 and 4,500 gal. capacity respectively. The advent of war caused the Government to require the maximum extraction of toluene and a limit of 2% toluene content of motor benzole was imposed.

The ring packed columns were, of course, inadequate for the degree of fractionation required and two bubble cap columns were erected, one replacing the ring packed column on the 4,500 gal. still and the other provided with a new still of 6,000 gal. capacity. The columns were 3 ft. 6 in. diameter and contained 23 trays.

New total condensers were installed on top of the columns thus giving reflux by gravity through a device which enabled the reflux to be varied. The plant was supplied by W. C. Holmes & Co., Ltd.

The increasing quantities of crude benzole and the much closer fractionation required to obtain toluole engendered further problems. Steam requirements were increased and two more boilers were installed to meet this demand. Additional feed water was required and a much larger supply of cooling water was needed to supply the reflux condensers and final coolers. A deep well was sunk and water raised from the borehole by a Sumo submersible pump. A new water softener was erected and, to conserve water, a cooling tower was built and condenser water circulated over it. An extra Typhoon washer of 3,500 gal. capacity was also constructed.

At this period great difficulty was experienced in reducing the sulphur content of the motor benzole below the specification limit without the excessive use of sulphuric acid and consequent washing losses. It was therefore decided to separate a forerunning fraction of high CS_2 content and to treat this fraction with Y.T.D. ammonium polysulphide reagent before blending back into the motor benzole.

The small Typhoon washer was dismantled and re-erected in a separate compound adjacent to the main plant together with the necessary tanks and pumps. Using this method of working, no difficulty was found in obtaining a motor benzole well within specification and at the same time producing a 10°C. range toluole.

To produce nitration toluene from this 10°C. fraction necessitated further acid washing and redistillation and was extremely difficult owing to the low gravity of the crude benzole at our disposal and the consequent high aliphatic or paraffin content. Closer fractionation was made possible by using a reflux divider of our own design together with a reflux recorder, and nitration toluene was produced conforming with Government requirements.

It will be realized that this set-up was not ideal and plans were completed for the erection of a continuously-operated plant. By this time, however, the war was drawing to a close and the scheme was abandoned. The production of nitration toluene from very low gravity crude benzole was not an economic proposition and was discontinued at the end of the war.

STATISTICAL PUBLICATIONS

We have received from the Institute of Municipal Treasurers and Accountants a copy of each of the six statistical booklets which are prepared each year jointly by the Institute and the Society of County Treasurers. These are for the year 1953-54 and give financial and other statistics of the health, welfare, children, fire, police, and education services administered by local authorities in England and Wales. The main basis of each return (except that for education) is an analysis of the expenditure on the appropriate service for each authority and for comparative purposes each item of expenditure is expressed as an amount per 1,000 population. The education booklet consists mainly of an analysis of costs per pupil (both primary and secondary). Each booklet contains averages and totals for the two classes of authority (counties and county boroughs) and for all authorities with corresponding figures for the previous year.

The return of *Local Health Services Statistics* includes unit costs for particular services—*i.e.* day nurseries, child welfare centres, midwifery, health visiting, home nursing, and domestic help. The summary tables show that the expenditure of all local authorities which falls on rates has increased from £19,390,654 to £19,982,145 since the previous year, which is equivalent to a rate increase from 14.00d. to 14.18d. The total expenditure falling on rates and government grants has increased from £875 12s. to £898 9s. per 1,000 head of population. The *Welfare and Children Services Statistics* are similar in form and they deal with the services provided under the National Assistance Act and under the Children Act, respectively. They show the number of persons or children for whom the local authority is responsible.

In addition to the analysis of expenditure and income per 1,000 population, the *Fire and Police Statistics* each contain supporting statistics of personnel, and in the case of the fire services booklet, statistics of appliances, fire stations, and calls received. The police statistics do not include the Metropolitan and City of London Forces. The *Education Statistics* show the number of pupils, the number of schools, and the number of pupils per teacher, and details of the cost of school dinners, in addition to the analysis of cost per pupil at primary and secondary schools. The total expenditure (rate and grant borne) of local education authorities has increased from £321,079,745 in 1952-53, to £337,373,904 in 1953-54, and the average rate equivalent has increased from 7s. 6d. to 7s. 10d., representing an increase of £6,801,106 in rate borne expenditure. The cost per pupil in primary schools has increased from £25.09 to £25.75, and in secondary schools from £46.28 to £47.43. Copies of all the booklets are obtainable at 3s. each, post free, from the Institute at 1, Buckingham Place, S.W.1.

The Italian State-owned Azienda Nazionale Idrogenazione Combustibili is to build near Ravenna a factory for the production from natural gas of 30,000 tons of synthetic rubber and 350,000 tons of nitrogenous fertilizers a year. Production costs are expected to be very considerably below the landed prices of syntheic rubber from the United States or Canada.

Theory and Design of Aerated Burners*

BY J. A. PRIGG, B.SC., A.R.C.S., D.I.C., ASSOC.M.INST.GAS E.,

North Thames Gas Board, Watson House.

THE term aerated burner is used to describe a burner in which air is mixed with the gas prior to combustion. The mixing of the air and gas is most commonly accomplished by means of a simple injector system and it is with this kind of aerated burner that the present paper is concerned.

The importance of the simple aerated burner to the gas industry of the present day hardly needs stressing. Most domestic cookers employ this form of burner, as do wash-boilers, washing machines and many gas fires and industrial appliances. All told probably 80% of the gas produced in Britain is consumed in this way. The aerated burner allows gas to be burned in a comparatively small combustion chamber with contact between the flames and the heated surface; this, together with its robustness, cheapness and simplicity has led to its wide use. The parts of the burner are referred to many times in the paper, and Fig. 1 gives a sketch in which these parts are named.

Historical

The invention of the aerated burner is usually attributed to the German chemist R. W. Bunsen in the year 1855. Two years previously, Heidelberg, where Bunsen had his laboratory, had been provided with a public supply of gas. Henry found that flame travel could be prevented by the use of a wire gauze.

Nevertheless, it is from the Bunsen burner that the modern aerated burner is derived. Its invention paved the way for a considerable expansion in the use of gas, both in the home and to industry. Thirty years later came the invention by one of Bunsen's students, Auer von Welsbach, of the incandescent gas mantle, a revolution in the method of lighting which could only succeed because of the earlier invention of the Bunsen burner.

The Aerated Flame

An examination of the familiar aerated flame (Fig. 2) shows that it consists of two distinct zones—the inner blue cone and the reddish-blue outer mantle. Both zones are very thin layers of burning gases. Within the inner cone is the mixture of primary air and gas supplied to the burner. At the surface of the inner cone burning occurs, resulting in the formation of a mixture of carbon monoxide, hydrogen, carbon dioxide, water vapour, nitrogen and a small proportion of methane or other hydrocarbons. The combustion of these gases is completed in the outer mantle by the diffusion and convection of secondary air with them.

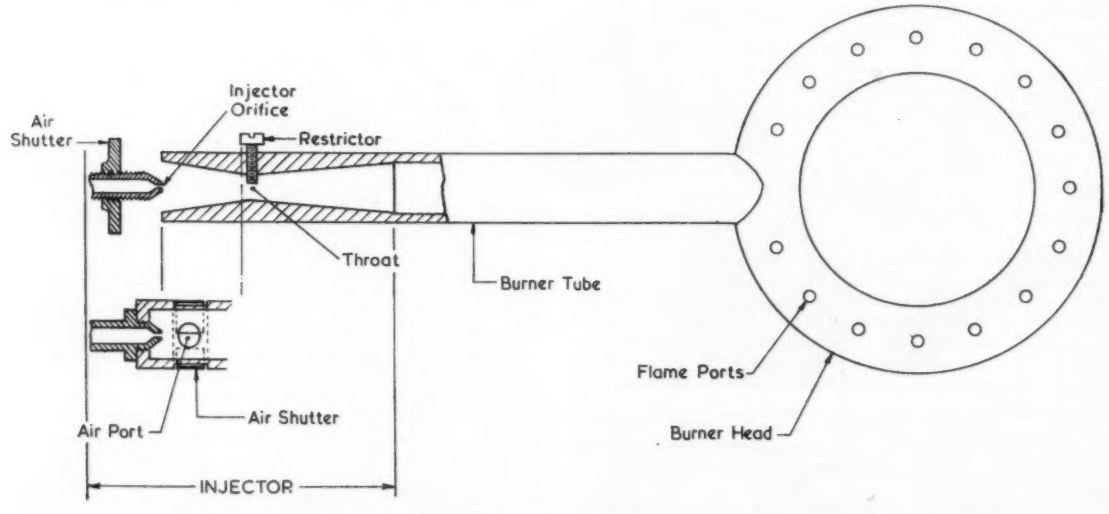


Fig. 1. Sketch of a typical aerated burner showing the parts of which it is comprised.

Roscoe, who was then working with Bunsen, had brought from England a gas burner used in the laboratories there. This was an Argand lighting burner in which the glass chimney had been replaced by one of copper, to the top of which was fixed a wire gauze. The air-gas mixture formed on turning on the gas burnt on top of the gauze, but the heat given off was not very intense. Bunsen was not satisfied, and, after some experiments on the relative sizes of the tube and the openings for gas and air, he evolved his well-known aerated burner.

It is clear from this account that an aerated burner was already in existence before Bunsen, and that the Argand burner described owed much to the discovery of Davy, who

If the air supply to the burner is reduced, the cone lengthens and its tip becomes yellow, while if the air supply is increased, the inner cone shortens, the outer mantle becomes smaller, and eventually, when all the air required for combustion is mixed with the gas, the outer mantle disappears (Fig. 3).

In some air-gas mixtures the kind of flame shown in Fig. 4 is found. These, known as polyhedral flames, occur in rich mixtures of hydrocarbon gases and air and in lean hydrogen or town gas mixtures. They are caused by the more rapid diffusion of hydrogen than of the other gases into particular zones at the high temperature of the flame. The shape of the inner cone is the result of an equilibrium between the velocity of the air-gas mixture through the flame port and the burning velocity at right angles to the cone surface.

The inner cone, however, is only roughly conical. A closer examination shows that it is rounded at the apex and flattened

* From a paper presented to the London and Southern Junior Gas Association on February 4.

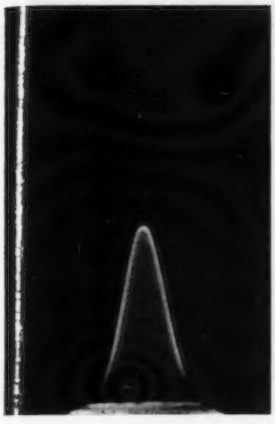


Fig. 2. Normal aerated flame.

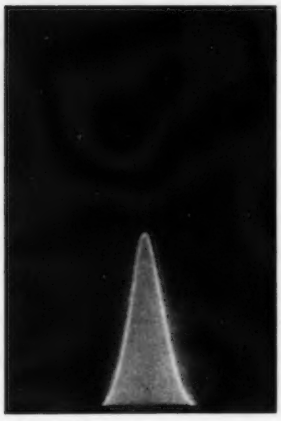


Fig. 3. Completely aerated flame.

Fig. 4. Polyhedral flame; 160% aeration.

at the base. This is caused mainly by the heating of the air-gas mixture as it approaches and passes through the flame and by the variations of velocity across the outlet of the burner.

Heating Effects

The mixture flowing towards the cone surface is heated for an appreciable distance from it, and burning begins before the visible flame is reached. The true burning velocity, therefore, occurs just inside the inner cone. By optical methods, the change in refractive index of the heated mixture can be detected and the equation given above is more accurate when these methods are used.

The preheating of the mixture is greatest at the top and least at the base of the cone. As burning velocity is increased by temperature, there will be faster burning at the top than at the base and the top becomes rounded. At the edge of the burner, too, the reacting particles are destroyed and the flame quenched, so that a 'dead space' is seen between the edge of the burner and the flame.

As the burning gases pass through the cone, they are heated and a large increase in volume occurs. The expansion of the gases in this way results in a thrust back on the flame surface. This always has an effect and may sometimes distort the flame considerably.

Another heat effect is caused by the outer mantle. If the amount of oxygen in the air surrounding the outer mantle is reduced, the inner cone becomes larger, although the primary air remains the same. This is because the outer mantle enlarges and becomes more distant from the inner cone and its effect on the burning velocity is less. Conversely, in an atmosphere rich in oxygen, the outer mantle shrinks closer to the cone, the burning velocity increases, and the cone shortens.

Stability of Flames

The burning velocity depends upon the nature of the gas and the proportion of air in the mixture. The fastest burning velocity is attained with rather less than the proportion of air required for complete combustion. For comparison, the maximum burning velocities of some of the common gases are given in the table below.

Gas	Maximum Burning Velocity (cm per sec)
Hydrogen	330
Carbon Monoxide	46
Methane	35
Propane	39
Butane	38
Ethylene	68

It will be seen that hydrogen is many times faster burning than any of the other gases, and town gas, because it contains about 50% hydrogen, will burn faster than the hydrocarbon gases, such as natural gas (methane) or butane.

If the velocity of the air-gas mixture passing through the burner ports is increased, the burning velocity will eventually be insufficient to hold the flame on the burner, and the flame will 'blow-off' or 'lift.' With decreasing velocity of the mixture the flame may pass into the burner and 'light back.' On practical burners, it is found that 'lift' has to be prevented with hydrocarbon gases and 'light back' with town gas, as would be expected from the comparative burning velocities.

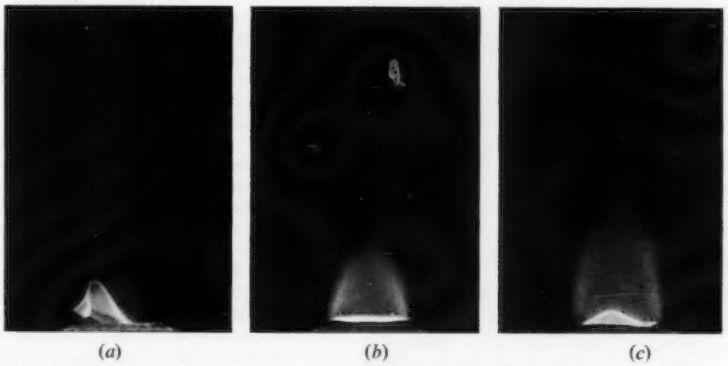
Both these effects are most likely to be initiated at the edge of the burner for it is here that the velocity of the mixture and the burning velocity are low and more nearly equal. As the flame cannot exist closer to the edge than the dead space distance, the effect will not occur immediately adjacent to the edge. Working with long straight tubular burners, Lewis and von Elbe have produced a theory of light back and lift which has been well substantiated for this type of burner. The theory postulates that the effects will occur for a given air-gas mixture at a certain critical value of the velocity gradient at the edge of the tube. Some of the types of light back, with a long straight tubular burner, are shown in Fig. 5. These photographs suggest that distortion of the flame by flame thrust has an important effect.

On commercial burners the type of light back shown in Fig. 6 appears to be the most common. Here the flame thrust has caused the flame front to become convex with respect to the burner and light back occurs in the centre of the port. It follows that it will become more and more difficult for the flame to light back in smaller ports. When the radius of the port has become about equal to the dead space distance the flame will simply go out as it is quenched as it goes through the port.

The lifting of flames is clearly illustrated in Fig. 7, for town gas. In this photograph lifting has started at one side of the burner suggesting that minute differences in the smoothness of the burner rim may be responsible for initiating lift.

Methods of Assessing Aerated Flame

In designing a burner for a particular gas it is important to know the kind of flame to be expected and its limits of stability. From the remarks in the preceding paragraphs, it will be seen that there are so many disturbing factors that the type of flame cannot be assessed from the fundamental ideas of burning velocity and velocity of the mixture. More empirical methods are therefore used. These methods, and the apparatus involved are discussed in the following paragraphs.



(*a*) (*b*) (*c*)

Fig. 5. Types of light back on a tubular burner: (a) Gas rate 5.8 cu.ft./hr./sq.in.; aeration 170%. (b) Gas rate 5.8 cu.ft./hr./sq.in.; aeration 57%. (c) Gas rate 12.8 cu.ft./hr./sq.in.; aeration 72%.

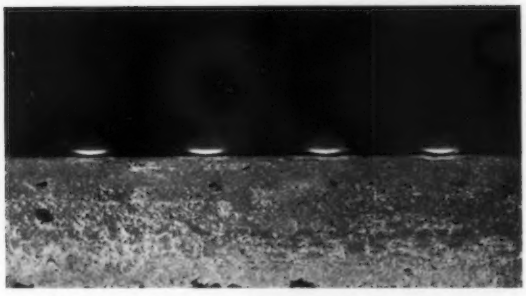


Fig. 6. Light back on a bar burner—gas rate 12 cu.ft./hr./sq.in.; aeration 60%.

Aeration Test Burner and Derived CHASO Curves

The aeration test burner is a bunsen type burner with a long burner tube to smooth out irregularities in the flow of the air-gas mixture. The burner tube is water-jacketed to maintain its temperature constant. Gas is supplied at a constant pressure and the air shutter is adjustable. The opening of the air shutter to give a cone height of 19 mm. is taken as a measure of the type of flame to be expected on commercial burners. The air shutter opening is expressed in terms of an arbitrary scale of aeration numbers. An aeration number of 50 on gas of 500 B.Th.U. per cu.ft. indicates that a short or 'hard' cone is to be expected, while a gas with an aeration number of 85 will give a long or 'soft' cone; an aeration number of 67 is considered the mean for gas of 500 B.Th.U. per cu.ft. The aeration tester burner can be used to produce curves of the cone height against air shutter opening (CHASO curves, so called from the initial letters of the factors plotted against one another). Some typical curves are shown in Fig. 8. These provide more information than the aeration number alone, in that they show more clearly the tendency to lift or light back.

The Flame Matching Burner

The flame matching burner has a similar purpose to that of the aeration test burner, but is considerably smaller. It is intended for use on the district to ensure that appliances are adjusted to have the correct kind of flame. It is a small bunsen burner, with a fixed air port and hardness or softness of the flame is assessed by the relative height of the inner cone.

Combustion Diagrams

Considerably more information on the type of flame and the limits of stability is provided by a combustion diagram. The apparatus used consists of a straight tubular burner to which are metered separate air and gas supplies. The limits of lift and light back and yellow tipping of the flames at various aerations and gas rates are noted and plotted on a diagram, the axes of which are heat input per unit area of the flame port and the composition of the mixture, expressed as the percentage of air of that theoretically required for complete combustion. The standard burner used is of 7 mm. diameter and the burner tube is maintained at 50°C. by means of a water jacket. Further details of the method are given by Fuidge and his collaborators who were responsible for introducing the method to this country.

Fig. 7. Lifting on a tubular burner (town gas).

Stability on Commercial Burner Ports

The methods described above for the examination of the stability of flames use long straight burners in which the flow of the air-gas mixture approximates to streamline. This type of flow, however, is not common in commercial burners.

The combustion diagram technique was extended by Fuidge to the examination of flames on commercial burners. His results indicate that generally stability is less on these burners. As the port size decreases, there is less tendency to light back. The light back areas, however, were not as reproducible as with the tubular burner, no doubt because of the effect of very small disturbances on the short cones just before true light back. Burrs left on the inside of the ports, for example, increase the light back area considerably. The curves shown are for the ports with the burrs removed. Deeper ports than these would be expected to give greater stability and this is borne out by American and French work. On commercial burners the heating of the burner, because it increases the burning velocity, leads to a greater tendency to light back; on the other hand the tendency to lift is reduced.

Practical Design Data for Town Gas

An important advantage of the aerated burner is that it is possible to obtain a high heat release in a comparatively small combustion chamber, having flame contact with the heated surface. In many applications of the aerated burner, a compact burner head giving the maximium heat release per unit area of flame ports is required. The design of a burner of this kind is considered first.

In other applications, it is desirable to have a lower heat output per unit of flame ports, while in still other applications, it may be desirable to spread out the flames as far as possible. Design of burners of these kinds is considered separately at the end of this section.

The steps in the design of an aerated burner with a compact burner head should be taken in the following order:—

(1) The calculation of the size of the injector orifice.
(2) The calculation of the total flame port area.
(3) The design of the burner head.
(4) The design of the throat.
(5) The design of the burner tube.
(6) The design of the air port and air control.

These items are considered in this order in the following paragraphs.

The Injector Orifice.

The injector orifice serves two purposes—it delivers the correct volume of gas to the burner and also provides a jet of gas which entrains primary air. To serve the second purpose to the best advantage the injector orifice should be mounted axially to the burner. A very considerable drop in aeration will be found for even small divergencies from the axial position since the momentum of the jet will be dissipated in collision with the walls of the burner.

The axial distance of the injector orifice from the throat of the burner is not critical; a position at some two or three throat diameters is generally satisfactory, but should be checked experimentally.

Fixed Orifice

The best method of gas supply to the burner is by means of a pressure governor and an orifice of a fixed size. In this way, variations in heat input rate are reduced to a minimum and depend only upon variations in calorific value and specific gravity of the gas. For different gases, the Wobbe grouping ensures that only four sizes of injector are necessary to cover most of the gases made in the country. In Table I the gas rates, at a pressure of 2.5 in. W.G., for a range of orifices are shown. The gas rates are for three discharge coefficients. An examination of the injector will generally show the approximate coefficient to assume.

Variable Orifice

An orifice of variable size or a fixed size with a pressure control is sometimes used to avoid the expense of a governor. The size of the orifice is usually varied by means of a needle which can be screwed into or out of the orifice. A reduction in the size of the orifice in this way will lead to a lower gas rate and also to a higher air-gas ratio. A pressure control consisting of a throttle in the gasway reduces the pressure of the gas immediately behind the orifice. Variation of gas rate by this means will not alter the aeration. Sometimes both orifice size variation and pressure control are used to-

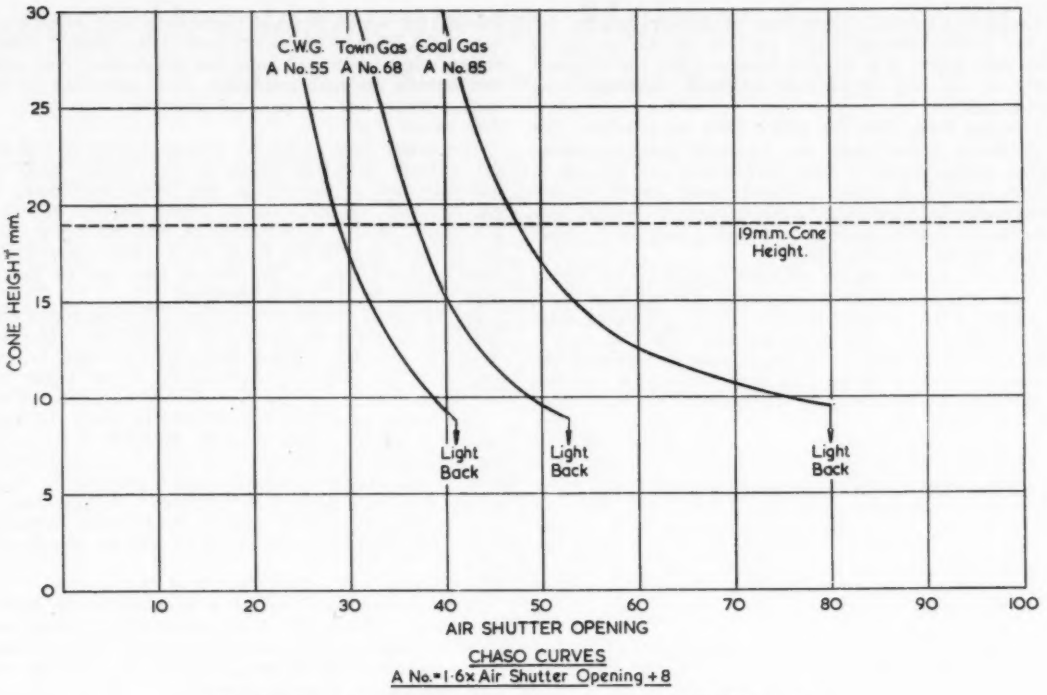


Fig. 8. Typical cone height/air shutter opening (CHASO) curves.

TABLE I. INJECTOR ORIFICE SIZES AND GAS RATES

Morse Drill Size	Diameter inches	Gas Rate—cu. ft. per hr. (S.G. 0.47) at 2.5 in. W.G. pressure		
		C = 0.95	C = 0.90	C = 0.85
N	0.302	259.0	246.0	232.0
I	0.272	211.0	200.0	188.0
F	0.257	189.0	178.0	168.0
B	0.238	161.0	153.0	144.0
3	0.213	129.0	122.0	115.0
10	0.1935	106.5	101.0	95.5
11	0.191	103.5	98.5	93.0
12	0.189	101.5	96.5	91.0
13	0.185	97.5	92.5	87.0
14	0.182	94.5	89.5	84.5
15	0.180	92.5	87.5	82.5
16	0.177	89.0	84.5	80.0
17	0.173	85.0	81.0	76.0
18	0.1695	82.0	77.5	73.0
19	0.166	78.5	74.5	70.5
20	0.161	74.0	70.0	66.0
21	0.159	72.0	68.5	64.5
22	0.157	70.0	66.5	62.5
23	0.154	67.5	64.0	60.5
24	0.152	66.0	62.5	59.0
25	0.1495	63.5	60.0	57.0
26	0.147	61.5	58.5	55.0
27	0.144	59.0	56.0	53.0
28	0.1405	56.0	53.0	50.0
29	0.136	52.5	50.0	47.0
30	0.1285	47.0	44.5	42.0
31	0.120	41.0	39.0	36.5
32	0.116	38.5	36.5	34.5
33	0.113	36.5	34.5	32.5
34	0.111	35.0	33.0	31.5
35	0.110	34.5	32.5	31.0
36	0.1065	32.0	30.5	28.8
37	0.104	31.0	29.2	27.6
38	0.1015	29.4	27.8	26.4
39	0.0995	28.2	26.8	25.2
40	0.098	27.4	26.0	24.6
41	0.096	26.4	25.0	23.6
42	0.0935	25.0	23.6	22.4
43	0.089	22.6	21.4	20.2
44	0.086	21.2	20.0	19.0
45	0.082	19.2	18.2	17.2
46	0.081	18.8	17.8	16.8
47	0.0785	17.6	16.6	15.8
48	0.076	16.6	15.6	14.8
49	0.073	15.2	14.4	13.6
50	0.070	14.0	13.2	12.6
51	0.067	12.8	12.2	11.6
52	0.0635	11.6	11.0	10.4
53	0.0595	10.2	9.6	9.0
54	0.055	8.6	8.2	7.8
55	0.052	7.8	7.4	7.0
56	0.0465	6.2	5.8	5.6
57	0.043	5.4	5.0	4.8
58	0.042	5.0	4.8	4.6
59	0.041	4.8	4.6	4.4
60	0.040	4.6	4.4	4.2

gether. The effects of orifice size variation and pressure control on the aeration of a burner can be demonstrated in the apparatus described by Blandon and Rigg.

The variable injector orifice is not recommended, for it has been found that the setting of the gas rate on the district is generally not very accurate. The best compromise, probably, when a governor cannot be provided, is the provision of a pressure control followed by a pressure point, so that the burner can be set to the correct orifice pressure. In these circumstances variations of gas rate are inevitable, however, as the pressure of supply varies.

The Area of Flame Ports

A normal air-gas ratio for gas of 500 B.Th.U. per cu.ft. is 2.0-2.5. On a gas of specific gravity 0.47, it is necessary to provide an area of flame ports at least equal to 25-30 times the area of the injector orifice for a normal commercial burner. With attention to smoothness of the burner and flame ports, a smaller area is possible when a more compact burner head will result.

Another method of expressing the area of flame ports required is in terms of the gas rate per unit area of flame port or as the heat input per sq. in. of port area. The above figures correspond to 0.007-0.009 sq. in. of flame port per cu.ft. per hour of gas or between 69,000 and 58,000 B.Th.U. per hour per sq. in. for gas of 500 B.Th.U. per cu.ft.

The Burner Head

The size and shape of the burner head and its disposition will depend very much upon the application for which it is intended. So, too, will the distribution of the total flame port area over the head in terms of the size and spacing of the separate flame ports. The following remarks can only give the general picture.

Small flame ports are recommended, for these have the least tendency to light back. A large number of small holes may be difficult, however, to accommodate on the burner head and will certainly be more expensive to drill than a smaller number of larger holes. Small ports, too, on cooker hotplate burners are more easily blocked by spillage, while if the burner is enamelled after drilling, the reduction of flame port area may be greater with small ports. Some compromise may therefore be necessary. For a large number of applications, a port size between 0.10 and 0.125 in. diameter will be found suitable.

Less tendency to light back is also obtained with deep ports, but depth of port increases the resistance. In general, a port depth of once or twice the diameter of the port has

been found satisfactory. Sometimes, on cooker burners, the ports are drilled through raised portions on the casting to increase their depth; it is thought, however, that the increased difficulty of cleaning the burner probably outweighs the greater stability.

Port shapes other than the drilled hole are possible. Die cast aluminium burner heads are frequently used on cooker hotplates, giving smooth burner ports which can be cast in the form of slots or squares. These burner heads are not recommended where the burner head is likely to become very hot in use, or where, if the burner lights back, the burner head will become hot and melt.

Similar port shapes can be obtained with cast iron burner heads, but as the castings are generally much less smooth, small slotted ports are not possible. New techniques may, however, make small clean ports possible with cast iron.

In burners having long burner heads, such as industrial bar burners or cooker grill burners, the air-gas mixture is removed by each successive port in turn. The velocity of the mixture at the first flame port is therefore greater than that at the last and uneven flame heights may result, for the mixture at those ports near the end of the burner is subject to a higher static pressure. One way to reduce the effect is to introduce the mixture in the centre of the burner head, so that it divides into two. Another and perhaps better method is to taper the cross-section of the burner head so that the velocity is maintained roughly constant. This is done, for example, in the case of gas fire burners. The cross sectional area of the burner should decrease in proportion to the number of ports still to be fed.

The spacing of the flame ports to ensure satisfactory cross lighting and the arrangement of the ports for access of secondary air is discussed in the next section.

The Throat

It has been shown that a throat area between 0.4 and 0.7 of the flame port area is required to ensure that the maximum entrainment of air is obtained. A value of 0.65 is suggested for the type of burner at present under discussion.

The essential characteristics of a satisfactory throat are that it should have:

(1) An entrance shaped to conduct the air-gas jet to the minimum cross section of the throat without undue loss of momentum.

(2) A divergence from the minimum cross-section as gentle as possible to the full cross section of the burner tube.

Although the divergence from the minimum cross sectional area of the throat should be as gentle as possible, often a short throat has to be used to save space. The effect of the length of the divergence on air entrainment can be seen for the throat sections taken from the Bureau of Standards Technological Paper No. 193. Halving the length of this portion of the throat resulted in a reduction of air entrainment of 9%. The entrance to the throat, it will be seen, is usually made about 2-2½ times the minimum diameter.

In cast iron burners, the throat is usually cast with the burner, but it can be made separately from brass or aluminium, and inserted in the entrance of the burner. The latter throats are smooth and have low resistances. For industrial bar burners, injector assemblies each consisting of injector orifice, throat and air port are available.

The Burner Tube

The burner tube serves the purpose of transferring the air-gas mixture from the throat to the burner head with a minimum loss of energy. In the throat, the energy of the gas is largely in the form of kinetic energy. In the head, this energy should be available as potential energy to expel the mixture through the flame ports. This suggests that the cross sectional area of the burner tube and of the burner head should be as large as possible.

In practice, a burner tube having a cross-sectional area not less than 1.5 times the flame port area will be found suitable. A smaller tube has a higher resistance and tends to limit the amount of air entrained, and because of the higher velocity of the mixture in it, may give rise to uneven flame heights.

The burner tube should preferably be about 10 diameters long after the divergence from the throat in order to smooth out irregularities in the flow. A burner of this length, however, is not always practicable and some loss in regularity of the flow may have to be accepted. On the other hand, it is sometimes possible, though rather more expensive, to obtain the desirable length of burner tube by bending it back on itself.

The Air Port

These recommendations for a compact burner head have been based on obtaining the correct aeration by using the best ratio of flame port area to injector orifice area; in this case, the air port area should be as large as possible and offer as little resistance to flow as is practicable. An air port area at least twice the area of the flame ports meets these requirements.

Control of the aeration may be required as, for example, in the lower Wobbe number gas group. This can be achieved by means of an air shutter or by means of a screw inserted in the throat of the burner. The former method is preferred since an obstacle in the throat may lead to spilling of gas from the air port when the burner is turned low.

Table of Burner Dimensions

In Table II are brought together the dimensions recommended for a compact burner head, that is for a high heat input per unit area of flame ports, and for burners with lower heat inputs per unit area. In the latter case the same size throat has been used and restriction of air will be necessary.

With low heat input rates per unit area, the velocity of the air-gas mixture from the ports is reduced and the practical limit for the area of ports is set by the stability of the flames, particularly in a draught. In Table II the maximum area of flame ports given is seventy times the area of the injector orifice. For burners protected from draughts it is thought that reasonable stability can still be obtained with a flame port area a hundred times the injector orifice area.

(To be continued)

TABLE II
BURNER DIMENSIONS
Town Gas—Specific gravity 0.47, Calorific Value 500 B.Th.U. per cu. ft.

Gas Rate cu. ft. per hr. at 2.5 in. w.g.	Injector Orifice C = 0.9		Flame Port Area sq. in.		Throat Diam. in.	Burner Tube		Size and Number of Drillings					
	Diam. in.	M.D.	High	Low		Minimum Diam. in.	B.S. Class B M.S. tubing Size I.D.	5/32 in.		1/8 in.		3/32 in.	
								High	Low	High	Low	High	Low
5	0.043	57	0.0436	0.102	0.20	0.30	¼ in. = 0.375	6	15	4	8	2	5
10	0.0595	53	0.0835	0.1945	0.30	0.40	⅜ in. = 0.47	12	28	7	16	4	10
15	0.073	49	0.1255	0.293	0.30	0.50		18	45	10	24	6	15
20	0.086	44	0.174	0.406	0.40	0.60	½ in. = 0.625	25	60	15	33	9	21
25	0.096	41	0.217	0.506	0.40	0.65		30	75	18	40	11	26
30	0.1065	36	0.266	0.620	0.50	0.70		40	90	22	50	14	32
35	0.113	33	0.302	0.704	0.50	0.75		45	100	25	60	16	37
40	0.120	31	0.339	0.793	0.50	0.80	¾ in. = 0.81	50	115	28	65	18	40
50	0.136	29	0.436	1.02	0.60	0.90		65	150	35	85	23	55
60	0.1495	25	0.526	1.225	0.60	1.00	1 in. = 1.06	75	180	43	100	27	65
70	0.161	20	0.610	1.420	0.70	1.10		90	205	50	115	32	75
80	0.173	17	0.706	1.645	0.70	1.20		100	240	58	135	37	85
90	0.182	14	0.780	1.82	0.80	1.30		115	265	62	150	40	95
100	0.1935	10	0.880	2.055	0.80	1.30	1¼ in. = 1.375	130	300	70	170	46	105
125	0.213	3	1.07	2.50	0.90	1.45		155	360	90	205	56	130
150	0.238	B	1.33	3.11	1.00	1.60	1½ in. = 1.56	190	450	110	255	69	160
175	0.257	F	1.56	3.63	1.00	1.70		225	525	125	295	80	190
200	0.272	I	1.74	4.07	1.10	1.85		255	590	145	330	90	215
250	0.302	N	2.15	5.00	1.30	2.05	2 in. = 2.03	310	725	175	410	110	260

Notes:—(1) Throat and burner tube diameters given are based on the recommendations given in the text. Throat diameter should not exceed the value given, but may be reduced to 0.8 of this value.
(2) 'High' refers to high heat input per unit area of flame port and 'Low' to low heat input per unit area. Design for high heat input is more critical than for low. Some restriction of air is required with low heat inputs.

Latest Developments in Making Gas from Oil

Midland Section Discusses Mr. Diamond's Institution Paper

At a meeting of the Midland Section of the Institution of Gas Engineers at Birmingham on February 18, Mr. C. C. Wood (Chairman of the Section) presiding, there was a long discussion on the paper, 'The West Midlands Approach to the Gasification of Residual Oil', which was given by Mr. G. le B. Diamond (Chairman of the West Midlands Gas Board) at the autumn research meeting of the Institution in November. It was thought that members would like to hear of developments since the paper was presented and to discuss it further in that light, said Mr. Wood, who announced that Mr. Diamond was unable to be present, but that the Deputy Chairman of the Board, Mr. W. R. Branson, was ready to introduce the contribution.

Mr. W. R. Branson said the work carried out on the gasification of oil by the West Midlands Gas Board had been a team effort, and he was grateful to Mr. S. K. Hawthorn and to Dr. M. J. F. Olden for agreeing to contribute to the discussion, and to bring up to date some of the information given in the paper, by presenting results obtained during recent months. In the paper Mr. Diamond had referred to the coal situation as it had developed since the commencement of the first world war, pointing out that while coal must remain the mainstay of the national fuel economy, the marginal aid of other fuel resources was now vitally necessary if the national fuel budget was to be balanced.

Further Incentive

Since the paper was written, the report of the Beaver Committee had been presented, and many of its main points accepted by the Government. The possibility of utilizing oil gasification as a means of reducing the consumption of coke for water gas manufacture was, therefore, a further reason for investigation on the lines of the work carried out by the Board. In 1953/4 the West Midlands Gas Board consumed 136,000 tons of coke for water gas manufacture, while for the country as a whole the quantity used was about 1.3 mill. tons. In Europe and in the Mediterranean the price of gas oil had already advanced beyond the economic range for gas manufacture, and fuel oils of various viscosities had been used for some time for the carburetted water gas process. The increasing demand for oil for diesel and jet engines was likely to result in similar price movements in this country, and the gas industry must be prepared for such a development by rendering itself capable of using other oils for which the demand was less. The possibility of using crude oil was also referred to, although there were obvious difficulties in the storage and handling of oil of such low flash point. The present refinery programme had resulted in some over-production of low grade petrols, and the use of that material was a further possibility before the industry.

The work described in the paper fell into two distinct lines. The first was the use of heavy oil in lieu of gas oil for the enrichment of carburetted water gas. This was initiated at the Solihull Works, and had since been developed at the Saltley Works, Birmingham. The second involved the catalytic cracking of oil, and again was commenced at Solihull, and followed by the installation of the Onia-Gegi plant at Stafford. Difficulties encountered at Stafford with the Onia-Gegi plant related principally to the high sulphur content of the gas, both as sulphuretted hydrogen and as organic sulphur compounds, and to the tar and naphthalene produced. The carbon dioxide in the gas was also high, in the range of 10-12%, and the yields of gas per gallon of oil had not yet reached the hoped-for levels. Some modifications had already been made with resulting improvements in gas yields, which had now reached about 1.05 therms per gal. Further modifications were proposed which, it was hoped, would result in further improvements and in overcoming some of the difficulties in the ancillary plant.

Dr. M. J. F. Olden said since Mr. Diamond's paper was published much valuable information had been obtained from the Onia-Gegi plant at Stafford even though some further difficulties had been encountered. During the latter half of November the plant was shut down because of a perforated dip-pipe in the washer-scrubber and a temporary repair was effected. However, a further shut down was necessary at the end of the same month when a rapid build up of back pressure on the catalyst bed made working difficult and caused a deterioration in efficiency. The catalyst was removed and screens freed of ash and catalyst dust. It was evident that oil ash was only partially responsible for the build up of back pressure and that sintering of the catalyst had contributed to this effect. It appeared that unsatisfactory spraying and localized 'hot spotting' caused the catalyst to sinter the fine powder formed, packing into the free spaces. Several types and sizes of sprays had been tried but none was entirely satisfactory.

The catalyst was replaced and its depth increased from 18 in. to 22 in. A layer of carborundum chips was laid on the top of the bed to minimize any sintering caused on the surface of the catalyst bed by chilling during the first stages of each gas making phase. A more permanent repair to the washer-scrubber dip was made by casting a refractory lining in situ. During the shut down an experimental Raschig ring packing, which had proved unsatisfactory, was removed from the secondary scrubber. Operation recommenced early in January and initially the results were somewhat disappointing, in that no real improvement in gas making efficiency was made. During the whole of that month an overall yield of 0.98 therms per gal. was obtained and a gas make oil yield of 1.21 therms per gal. This compared with cumulative figures since the plant first operated in May, 1954, of 0.95 and 1.19 therms per gal. Up to the end of January approximately 425,000 gal. of oil had been consumed in making 84 mill. cu.ft. of gas (393,000 therms). From February 4 to 17 a considerable improvement in efficiency had been achieved and for this period thermal yields averaged 1.035 overall and 1.275 make oil. Whereas the overall figure was lower than that reported in the Solihull and 'Segas' plants it must be reiterated that at Stafford the waste heat boiler provided all the steam requirements of the plant, including heating, and exported surplus steam to the main works.

Tar Treatment

There was little to report on the ancillary side of the plant. The tar was still obtained in a highly emulsified state containing up to 50% water. Some reduction in this water content had been effected by the use of surface active agents (Bitran T) but the problem was still serious and a solution was being sought urgently. Among possible solutions the use of creosote oil in small quantities in the washer-scrubber was shortly to be investigated. Preliminary tests had proved encouraging. Mobility of the tar emulsions had been only slightly effected by internal steam tracing of pipe lines.

The gas made still contained an excessive quantity of organic sulphur (45 to 50 grains per 100 cu.ft.) and prior to purification an H_2S content of 350/450 grains per 100 cu.ft. The high CO_2 content persisted and it was no longer felt that this was entirely a function of the catalyst. There was cyclic evidence to support the theory that a proportion of CO_2 might be formed by a low grade water gas reaction. It was felt that high sulphur content of the gas might be reduced by a more efficient spraying arrangement which precluded excess carbon deposition on the bed and 'hot spotting'. It was with this end in view that certain modifications in the plant were to be made in the near future. Work had not proceeded as quickly as might have been possible but the plant had been run not only as a development unit but as an integral part of the Stafford undertaking gas making plant, supplying an average of 30% of the works output when in operation. On occasion, new work had therefore been relegated to the necessity for maintaining gas supplies at Stafford.

In addition to the proposed modifications already mentioned, new projects included the gasification of gas oil, crude petroleum and 3,500 sec. fuel oil. In the case of the latter it was hoped that the potential pressure of the less aromatic

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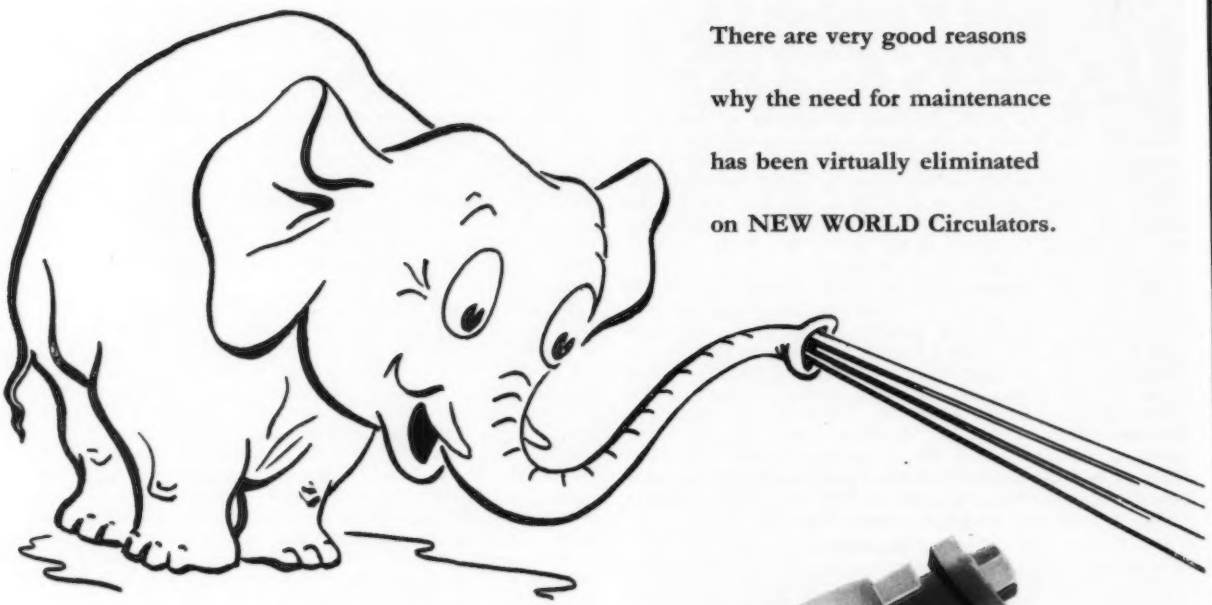

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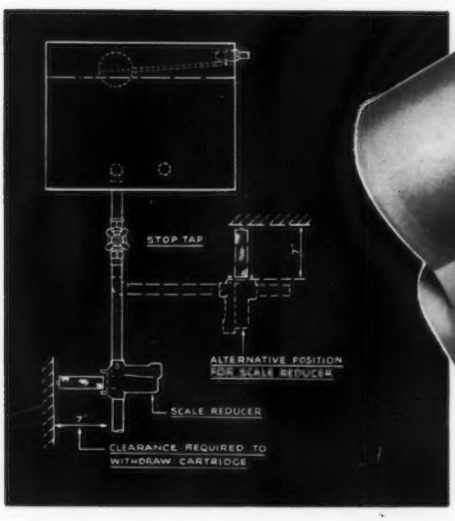

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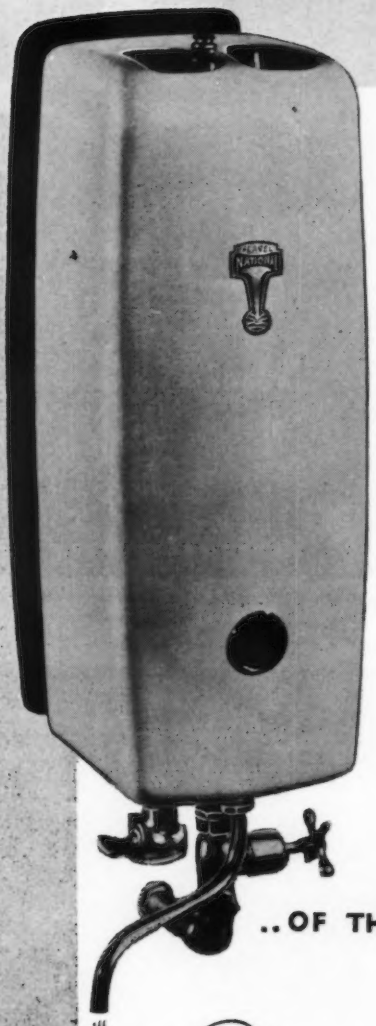

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compounds might lead to a higher cracking efficiency. At present they were reasonably happy with progress and with the recent increased thermal efficiency some of the problems of operating the process seemed near to solution.

Availability of Black Oil

Mr. S. K. Hawthorn (Birmingham) said that when the work was initiated more than five years ago there seemed every probability that black oil would be readily available, but the position was now so changed that it was not at all certain that the gas industry could count on unlimited supplies of black oil as a raw material for gas making. A further factor had come into the picture since the paper was written—the publication of the report of the Beaver Committee on air pollution and the subsequent expressed intention of the Government to implement the recommendations of the Committee. How, he asked, would the increased demand for coke be met? Should they continue to use large quantities of coke for water gas manufacture?

The work at Saltley had proved that heavy oil of 1,000 sec. viscosity could be gasified in a suitably modified C.W.G. plant without difficulty. There were many problems to solve and he would emphasize that only long continuous runs could prove that satisfactory operating conditions had been achieved. It was easy to be misled by an apparently successful short test.

The two difficulties anticipated were emulsion troubles and a build up of carbon in the carburettor. Emulsion troubles were solved during the first experiment on a small hand-operated set at Solihull, where an electro-detarrer was available and could be connected up to the water gas stream. This detarrer, operating on the gas at 100-120°F. was the complete answer to emulsion trouble, and experimental work on the larger set at Saltley was held back until detarrers could be installed. The tar produced was rather more viscous than normal water gas tar but the orthodox process of heating in vertical tanks after pumping from the separators readily produced a saleable tar of less than 5% water content.

Carbon Accumulation

As far as carbon accumulation in the carburettor was concerned the Solihull tests indicated no trouble but it was realized that the periodic shut down for clinkering might be helpful in burning off carbon. Trouble on this score arose at Saltley on the larger automatic plant. The maximum C. V. that could be obtained by injecting heavy oil in the carburettor was about 375 B.Th.U. per cu. ft. and even at this figure there were occasionally discharges of black smoke from the stack. A larger secondary air connection to the carburettor was fitted last October and the plant had worked almost entirely on heavy oil since. The carburettor was examined at Christmas and found to be quite clean. It had been found that heavy oil injection into the modified carburettor was still limited but the following figures could be compared with those in the paper: make per 24 hours, 2.13 mill. cu.ft., C.V. 402 B.Th.U. per cu.ft. gaseous therms per gal. of oil, 1.024.

For the past four months the plant had been operated with heavy oil injected into generator and carburettor simultaneously and the following typical result could be compared with those given by the Author: Make per 24 hours, 2.4 mill. cu.ft., C.V. 463 B.Th.U. per cu.ft. gaseous therms per gal. of oil, 1.

The plant at Saltley worked well and was quite as reliable as when using gas oil but the make was down by about 11%. It must be stressed that the Saltley carburettor was too small; only half the original carburettor was now used for oil cracking as the other half was taken up by the air preheating section and the spraying space. New C.W.G. machines now being installed at Nechells works, Birmingham, would have proportionately larger carburettors and were expected to produce 450 C.V. gas using heavy oil in the carburettor only.

Mr. T. F. E. Rhead said the oil feed consisted of a wide range of compounds—each with a different sensitivity to the action of the catalyst bed, and a somewhat inefficient average cracking result was likely to result. Would it not be possible and practicable to use a catalyst bed with graduated cracking activities so as to give a succession of selected crackings to cover the different constituents in the oil feed? This might or might not lead to an improved overall cracking efficiency.

Mr. E. T. Pickering, replying to an enquiry concerning oil quantity, said that samples with paraffin contents as low as 55% had been recorded, and such oil would be expected to prove inferior in use.

Mr. Branson referred to the work on the hydrogenation of oil under pressure already reported by the Gas Council's research staff, and to the continuation of this work, which would shortly be undertaken by them at Solihull.

Mr. Plevin, Mr. Stanier and **Mr. Brown** also took part in the discussion.

Mr. Branson Sums Up

Mr. Branson, commenting on the discussion, said Mr. Hawthorn had referred to the fact that over 1 mill. gal. of heavy oil had now been gasified in the C.W.G. plant at the Saltley works. Trouble with the emulsions had been overcome in the early work on C.W.G. at Solihull, where a detarrer working at a temperature of 100-120°F. had been available. With the use of de-emulsifying agents no trouble was being experienced at Saltley. The paper, in the absence of reliable figures, had assumed a tar yield of 12½% of the oil used. It was now possible to say that, over a six months period, the tar yield had exceeded 20%. This would slightly improve the costs given in the paper.

The provision of an increased air supply to the carburettor of the Saltley plant appeared to have overcome the earlier difficulty with carbon deposition. It was pointed out that the carburettor of this plant was too small for the use of heavy oil, and that better results were expected in the new installation of 3-5½ mill. cu.ft. per day C.W.G. sets now under construction at Nechells works, as these were designed for heavy oil. The oil used at Saltley had varied considerably, the Conradson carbon ranging from 8.8% to 10.7%. With the higher figure, the output of the plant was 10-11% below that with gas oil.

Turning to the work on catalytic gasification at Solihull, Mr. Hawthorn had stressed the importance of temperature control in the catalyst bed, and referred to the great improvement in that control which had followed the installation of a Honeywell-Brown electronic temperature indicator. The C.V. value of the gas was directly affected by the catalyst temperature, as the following figures showed:—

Catalyst Temperature	Calorific Value
880°C.	535 B.Th.U. per cu.ft.
895°C.	510 „ „ „
910°C.	480 „ „ „

Higher temperatures had been found to lead to some sintering of the catalyst, and in order to obtain lower calorific values without this, a trial was to be made shortly with a longer time contact obtained by means of a 3 in. increase in the depth of the catalyst bed. The yields obtained of 1.23 therms per gal. compared favourably with those in the Onia-Gegi plant at Stafford. The economics of the process might be further improved by the use of the tar produced, instead of the burning oil now used and by the extraction of benzole, of which the gas contained 0.08 gal. per gal. of oil used.

Dr. Olden had referred to the difficulties with tar and naphthalene encountered at Stafford, and to the measures being taken to overcome them. To date, some 500,000 gal. of heavy oil had been used with an average yield of 0.95 therms per gal. of oil (excluding oil for raising heats from cold). The carbon dioxide in the gas continued high, and was now in the range of 12% to 14%, the specific gravity of the gas being approximately 0.57. The dry tar yield amounted to 19.5% of the weight of the oil used, or 14.8% on a volumetric basis. Up to 40% of oil gas had been distributed on the Stafford district without complaints of combustion difficulties. In view of the probable lower content of cyclic compounds in heavy oil of 3,000 secs. viscosity, it was proposed to carry out a trial with this material, as well as with gas oil.

Reference had been made to the use of crude oil in a normal C.W.G. plant at Stourbridge, and it was said that later tests had shown gas yields some 20% better than those reported by Mr. Diamond in presenting the paper at the November meeting of the Institution. Results on gas oil at Stourbridge were not as good as expected and obtained in early tests there, and it had been asked whether this was due to a variation in oil quality, which might be overcome by purchasing to a specification

The **Chairman** (Mr. C. C. Wood) proposed a hearty vote of thanks to Mr. Branson and other speakers who had helped to provide an interesting and instructive afternoon, which **Mr. Corrigan** (Senior Vice-Chairman) seconded.

TECHNICAL PROBLEMS IN THE UTILIZATION OF TOWN GAS IN INDUSTRY

Following is a report of the discussion on the paper on 'Technical Problems in the Utilization of Town Gas in Industry' which F. Dickinson and F. J. Johnson, Divisional Industrial Gas Engineer and Deputy Divisional Industrial Gas Engineer respectively of the Sheffield and Rotherham Division, East Midlands Gas Board, presented to the Eastern Section of the Institution of Gas Engineers on February 17. The paper was published in the 'JOURNAL' of February 23 (pp. 515-523) and March 2 (pp. 586-589).

Mr. W. A. Evetts, M.C. (Chairman of the Section), introducing the discussion, welcomed Mr. W. K. Tate, President of the Institution of Gas Engineers, Mr. R. F. Hayman, Industrial Gas Officer, Gas Council, Mr. H. R. Hems, Industrial Gas Officer, West Midlands Gas Board, and other visitors.

Mr. G. E. Thomas (Industrial Gas Engineer, Watford Division) said the Sheffield and Rotherham Division presented one of the romances of industrial gas development in this country. With its very considerable load, notably in the steel industry, it was easy to appreciate that problems of a highly technical nature arose. In tackling such problems the industrial gas engineer was left very much to his own resources and ingenuity, and in areas involving specialist trades and industries he was in an even more isolated state of self-dependence. The need for accurate assessment of consumer demand was emphasized for obvious reasons—availability, and planning to make available, were inter-dependents. It was not a difficult problem when the consumer's product and processes were known.

A serious problem at Watford was how to estimate the industrial demand of new development areas in the four new towns where there were unknown quantities. Acreage was the only known factor. They had available only statistical information obtained from two existing large industrial estates similar in character. Such information, sketchy as it was, gave them something to work on and showed a saturation of one factory per acre with an average of 1,000 cu.ft. per hour maximum connected load and an annual consumption of 10,000 therms per factory. Those figures were eventually endorsed by Tyrrell from statistics obtained on a similar estate in the area of the North Thames Gas Board.

Condensation Bugbear

Condensation was one of the biggest bugbears of fluing gas boilers. So many variables were encountered in practice that it was difficult to lay down any hard and fast remedy. They had had experience of this in a considerable way at Watford in some 500 central heating installations alone, 400 of which were served by brick chimneys. The principle of incorporating an air ventilator in the base of the flue had been practised with success, but it should not be taken as the sole remedy; neither should it be taken in every case as a guarantee against condensation. Their experience had shown that it was necessary to make a detailed examination of every chimney into which a boiler flue would be led. In certain circumstances they had avoided brick chimneys; in other cases they had even short-circuited long and involved chimneys.

He did not agree with the authors' theory on the purpose and effect of ventilating the flue, and he wondered whether they had conducted any tests to support their views. It had been generally accepted that dilution of products by diffusion of gases with consequent lowering of dewpoint was the ultimate aim. Condensation was not limited to gas boilers only, but had been experienced to a large extent with small domestic type solid fuel boilers. In fact the problem had been of sufficient magnitude to warrant an investigation by the Building Research Station, which had published a pamphlet on the subject for the guidance of architects and builders.

He could not contribute to the authors' view that sulphur in gas was an exaggerated bogy. It was only too well realized that there was sufficient disquiet in the industry today to justify a full investigation into the cost and advantages of sulphur reduction. He sympathized with their concern at additional loading of price to the consumer, but he viewed a possible cost of a halfpenny per therm for reducing sulphur to 10 grains per 100 cu.ft. as worth while. Apart from industrial processes the entire field of utilization would benefit. The insidious effects of sulphur on the dewpoint of flue gases, condensation, corrosion, and pollution of the atmosphere in direct heating space and process sytems were only too well appreciated. Sulphur in that respect was detrimental not only to efficiency but also to prestige.

Variation in Gas Quality

The problem of variation in gas quality had always been with them, but it had been somewhat aggravated by integration of manufacturing and distribution systems since vesting day. He had had little first hand experience of difficulties arising from variation in specific gravity, but he would like to ask on behalf of some of his colleagues who had had such experience whether the authors had had any experience of the Sigma-Kent index control. He inclined to the view that technical service, no matter how good, was not sufficient where costly processes were involved. Sulphur and quality variations were undesirable features which should be minimized at their source.

He shared the authors' concern at the danger of over-elaborating controls, notably on box ovens, but he did not think that position applied today. The fact remained that from the report of the Inspector of Factories flame failure devices were having the desired effect of ensuring correct lighting procedure and preventing what the authors described as 'contempt bred of familiarity.' It was always difficult to ascertain the reason for an explosion. The operator was generally sure in his own mind that he had observed the correct lighting procedure, but it was equally certain that if he had done so no explosion would have occurred. For that reason devices were essential to ensure correct lighting procedure, and, in the absence of an established igniting source, to fail to safety. Most of such devices were simple in character and easy to understand. If, however, there became a tendency to complicate control equipment, the answer was very much in their own hands, for while it might be the Factory Department's responsibility to will the end, it was the gas industry's duty to will the means.

Boiler Design

The authors' expressed desire for change in boiler design and method of heating was welcomed and generally accepted, not necessarily from the standpoint of heat transfer only, but rather from the need for reducing the number of burners and thereby simplifying control. He doubted the wisdom of external heating, and failed to see that insulating efficiency at 300°F. would be any higher at 180°F. On the subject of solution heating of aluminium alloys, a complete battery of hot air circulating furnaces was installed at the De Havilland Aircraft Company's works in the middle 1940s. The furnaces were of the elevated type, 35 ft. high, with quench pit immediately below suitable for taking sheets, complete wing spars, and could be used for solution heating or annealing, and were fitted with potentiometric programme controllers for that purpose. The quench pit, charge cradles, and furnace base were all movable, under hydraulic action controlled from a central panel, under the supervision of one man.

The authors had spotlighted an important and significant aspect of their work which he hoped would not pass unnoticed. He referred to the considerable associated technical

knowledge needed by industrial gas engineers on subjects unrelated to gas and fuel technology. While accepted as being necessary to the fulfilment of the task, such knowledge must be acquired elsewhere, by some means or other; there was no planned or acknowledged course of suitable subjects. Today there were some 150 full-time industrial gas engineers mainly responsible for 26% of the country's total gas sale. New recruits were needed to meet rapidly increasing demand. The whole subject of training and education of engineers to specialize in the industrial field was a matter worthy of serious consideration by the Institution of Gas Engineers. In his view it was essentially a domestic matter that they should attract the right type of man for that purpose with a sound background in the gas industry and see that they were trained and educated suitably to meet the exacting demands of that young and virile branch of their profession.

Automatic Controls

Mr. R. F. Hayman, Industrial Gas Officer, Gas Council, said the authors had been kind to the production side of the industry in their remarks on variation in gas quality. It was probably a tribute to the production engineers that in one particular area in London the G.E.C. was still the biggest industrial gas consumer, where they had to work within close margins of flame. The importance of constant characteristics must never be under-estimated, and anything that could be done by way of developing automatic control and recording mechanisms for calorific value to make the path of the specialist engineers easier would be worth while.

Referring to the use of B.M. meters in parallel, there was always the chance that one meter would carry the load; regarding meters generally he felt that huge meters nearly half the size of the room in which they were assembled were horrors which they ought to avoid. On the question of flame failure devices those who worked on the industrial side were proud of their achievements, because they had always set a high standard. They had insisted on high standards of installation and maintenance, and they had striven to eliminate equipment which did not conform to those standards. They were determined not to fit flame failure devices if they could avoid it; where they could not avoid it, then they insisted on the devices being good. There was a danger that equipment might be fitted with too many controls, and they would be faced with the necessity of having controllers to control controls.

He stressed the value and importance of close co-operation between the industrial gas engineer and the consumer, and the pooling of knowledge and experience among industrial gas engineers. Their work was highly complex, and no one man could have full knowledge; he must therefore rely on the help of other people in the circulation of technical information.

Safety Rules

Mr. W. K. Tate (President of the Institution of Gas Engineers), said the paper emphasized the point he had always made that the purpose of the district sections of the Institution was to enable people in the different sections of their profession to discuss their widely differing problems. It was right that they should be reminded that they were working together, and that one side of the industry could contribute to solving the difficulties of another side. The authors had referred to safety. The Institution had its Gasworks Safety Rules Committee, which had been very active in drawing up its safety rules, and he thought there was a tendency which they had to guard against of taking away from a man his individuality. He sympathized with the authors when they said the best safety precautions were common sense and concentration on the particular operation on which a person was engaged. No safety measure would eliminate carelessness; they must inculcate in the mind of every employee the feeling that he must have his mind on his job.

Mr. A. H. Bird, Industrial Sales Manager, Tottenham Division, sought information as to methods and burner equipment used for the continuous hardening of magazine band saws of sizes from ¼ in. to ¾ in. He had a prototype hardening machine on the drawing board on which it was intended to use Marshall type precision gas/air burners, and would welcome any suggestions based on experience in that field. The authors' remarks about variation of combustion characteristics concerned works engineers and industrial men. There were two main processes with which he was acquainted that were super-sensitive to changes in combustion characteristics, changes outside the limits imposed by statute. They were glass working with precision burners as practised in the manufacture of electric lamps, radio and television valves, and vacuum flasks, and the use of town gas in the generation of prepared furnace atmospheres. The sensitivity in the first group was becoming greater as working speed increased, and in the second group as the many other variables in the process came under more thorough technical control.

'Look at Your Tools'

He agreed with the authors that they should not jump to the conclusion that gas was at fault in every reported case of trouble. But after careful investigation they should be prepared to look at their tools (to use their metaphor) and see whether or not they were blunt. He disagreed with the authors' suggestion that there was hardly a problem at all so far as variation in combustion characteristics were concerned, and that even if one had to be admitted, there was a facile solution to it. If the generator mentioned in the paper was used to make a gas suitable for annealing tough pitch copper, which would necessitate running it within the fine limits of zero O_2 and about 2% H_2 in the gas produced, the effect of town gas variations would soon be apparent, resulting in oxidation on one hand or hydrogen embrittlement on the other. Their customers often employed skilled chemists and metallurgists who could diagnose the symptoms as well as, or better than, they could. Furthermore, some firms with American associations had learnt how similar troubles disappeared when a change was made from manufactured gas to natural gas.

The volume of gas used in these super-sensitive processes was not a large percentage of industrial sales and the whole matter must be kept in perspective. But troubles from changes in gas quality could be very costly to their customers and cause a lot of annoyance. Although they were not under any statutory obligation to eliminate the causes of the trouble he believed it was wise to attempt it for a good customer. There were several possible lines of action—providing a supply from one works only; operating valves in the mains system to gain a similar effect; and altering works boosting programmes, to be tried according to circumstances. These remedies were outside the sphere of action of the industrial engineer. Where it had seemed advisable to try such measures in the Tottenham undertaking the initiative had come from Mr. E. O. Rose, the Divisional Engineer, and his (Mr. Bird's) section had always enjoyed the fullest co-operation of his assistants.

There was now available an instrument for compensating for change of quality automatically where frequent and unpredictable changes occurred that could not be dealt with by the methods mentioned. It consisted of a modified Sigma Wobbe Index recorder fitted with Kent pneumatic control equipment which, by controlling the admission of an extraneous gas into the supply to the machine or works department, maintained a constant Wobbe Index. The instrument had already proved its value in a lamp works, and he believed it would soon show itself equally effective in controlling an atmosphere gas generator.

The Authors Reply

Mr. Dickinson, replying to the discussion, said he agreed with Mr. Thomas as to the difficulties in assessing the industrial demand in new development areas. They could not solve the problem merely by looking into a crystal, and they could not have a clue as to diversity of trade in any one particular area. All they could do was to collect such information as they could get in respect of similar existing development areas, think ahead, and put in gas mains of adequate capacity to meet potential loads. He referred Mr. Thomas to the Northern Gas Board for some factual information regarding the gas development in the Team Valley Trading Estate, Gateshead-upon-Tyne. He was surprised to learn from Mr. Thomas that the principles of flue gas evacuation outlined in the paper had not proved to be so satisfactory as he had found in his own experience over 25 years. The successful application of those principles had been confirmed spontaneously by one of the leading makers of gas-fired boilers, but there might be some variation in application which had affected the results;

with regard to the sulphur content of town gas, Mr. Dickinson maintained that this did not have any appreciable effect on the normal products heated in industrial furnaces, and was rarely noticed. At Newcastle the sulphur content had always been about 10 grains per 100 cu. ft., without any additional charge being made and, as he had pointed out in the paper, any such charge could price gas out of industry in an area of keen fuel competition.

Wide variation in specific gravity would affect appliances employing injectors or natural-draught type burners, but would rarely be noted with air-blast or similar equipment. He had no personal experience of the Sigma-Kent index control unit, but would expect it to be a very useful addition in certain instances where flame-length variation was critical. The increased use of safety controls was good practice, but an essential requirement to successful operation was frequent checking and periodic maintenance. The number of such controls being installed was growing rapidly, and some makers were instructing users to go to their gas boards for this maintenance work. The difficulty foreseen was that there were insufficient maintenance men available with training and knowledge sufficient to cope with the number and variety of these controls.

Shortage of Trained Engineers

There was a shortage of trained industrial gas engineers. It should be borne in mind that they must not only know something about the industries for which they had to cater, but must have a background knowledge of mechanical, and possibly civil, engineering; they must be able to talk to their consumers in their own language, and realize the type of problems with which they had to cope.

Mr. Johnson, in reply to Mr. W. K. Tate, indicated that while spring makers were all agreed on the practical advantages to be obtained by the shot peening process (a special operation entailing the bombarding of the tension side of the heat-treated leaf with $\frac{1}{32}$ in. diameter cast iron shot) there appeared to be some confusion of thought as to the precise action on the surface of the metal itself. In a detailed written reply the evidence indicated that shot peening was a less costly method of removing surface cracks or defects than grinding, and the action of bombarding actually 'work-hardened' the surface, so assisting in extending the life of the spring.

Time would not permit more than brief rejoinder to the queries raised by Mr. Bird, but the following points were made subsequently in a full written reply to him: The hardening of bandsaws required precise and critical heat application, which was not too difficult in the case of any one job, but it was not so easy to provide equipment capable of simple adjustment by the operator over a fairly wide range of bandsaws owing to differences of widths and weights of material to be heated with equal precision in a defined period.

Control of Burner Equipment

On the question of variations in combustion characteristics, while in agreement with Mr. Bird in respect of the desirability of precision control of burner equipment relating to flame-heating applications of the types mentioned, it was felt that the majority of these were not as super-sensitive as indicated and would not generally provide real difficulties if the burners were set to the mean A.T.B. number of the gas supplied to a factory. In those cases where precise flame length was a very critical factor the use of such controls as the Sigma-Kent unit was obviously advisable. Mr. Dickinson could not agree that atmosphere gas plants were as super-sensitive as Mr. Bird thought, and gave two factual instances in corroboration of his views. His experience was that if these plants were properly operated even wide variations in combustion characteristics would not affect the final atmosphere gas, and operators were actually unaware of any such variations.

Dealing with the annealing of tough pitch copper, to overcome either oxidation or hydrogen embrittlement, the solution was to burn the town gas with a slightly oxidizing atmosphere in the combustion chamber, thus having negligible H_2 quantities, and incorporate an O_2 removal unit in the line to prevent oxidation of the copper. Replying to a question by Mr. Tate regarding radiant tubes used for heating malleable iron annealing furnaces, Mr. Dickinson said the tubes were made of Darwin's No. 1225 heat-resisting steel, having a content of 12% nickel and 25% chromium. The working temperature of the tubes was approximately 950°C.

Mr. R. C. Wardell (Boston) proposed and **Mr. E. O. Rose** (Tottenham) seconded a vote of thanks to the authors.

TIN RESEARCH IN 1954

We have received from the Tin Research Institute, Perivale, Greenford, Middlesex, a copy of the annual report of the International Tin Research Council for 1954, covering the work of the Tin Research Institute and the eight overseas organizations comprising the International Council. Among the main subjects of research at the Greenford laboratories during the year were the newly perfected bearing alloys made of aluminium-tin alloy. These alloys can be used in massive form, but the main interest lies in bearings made from steel strip coated with a thin layer of aluminium-tin alloy; the difficulty of securing a strong bond between these two materials has been overcome. The laboratory tests indicate that even at loadings of 6,000 lb. per sq. in. these bearings have excellent running properties. Commercial development is under way in England. The continuous casting mechanism devised in the Institute was demonstrated during the year to representatives of more than 20 firms from Great Britain, France, Belgium, Australia, and New Zealand. Solid and cored bronze rods, up to 10 ft. in length and of various diameters, have been produced.

Two electroplated alloys invented at the Institute are now coming into widespread use. Tin-zinc alloy electroplate is a matt finish for steel, and its performance in marine conditions, as a protective coating, is well established. Details of this finish are now available in the Ministry of Supply's Specification D.T.D. 927. The tin-nickel alloy electroplate, on the other hand, is intended for all metals requiring a permanent brilliant finish. Both tin-zinc and tin-nickel electroplates are being widely adopted in industry.

The report concludes with a list of the publications issued during 1954. These cover all the main applications of tin; many are available on request, free of charge, from the Greenford headquarters.

LONG SERVICE IN THE SOUTH EAST

Mr. W. K. Hutchison, Chairman of the South Eastern Gas Board, at a ceremony at Croydon on February 21, presented gold watches and clocks to 65 employees who have recently completed 40 years service in the industry. Among the recipients was Mr. A. G. Gostelow, the Board's Coal and Shipping Manager, who has been associated with Wandsworth gasworks all his working life.

Mr. Hutchison said that more than 5,000 of the Board's employees had over 25 years service each and about 800 had completed 40 years service.

Mr. W. K. Hutchison, Chairman of the South Eastern Gas Board, congratulating Mr. A. G. Gostelow (left) on his 40 years service in the gas industry. On the right, looking on, is Mr. R. J. McCrae, Personnel Manager.

'THE HAPPY HOME' SCORES A HIT

at the 1955 Ideal Home Exhibition

The Queen is welcomed by Sir Harold Smith, Chairman of the Gas Council, to the Gas Pavilion, which she visited during her tour of the Ideal Home Exhibition. On Her Majesty's right is Viscount Rothermere and on her left is Mr. L. E. W. Stokes Roberts, Organizer of the Exhibition.

The Ideal Home Exhibition sponsored by the *Daily Mail* has been termed 'a unique international domestic market place.' The description is an apt one in that this exhibition constitutes perhaps the most remarkable shop window for domestic appliances and equipment in this country; the international element is particularly noticeable this year in the many exhibits from food-producing countries overseas. In our editorial comment last week we enthused about the important rôle played by gas at the 1955 Ideal Home. It is now our intention to elaborate a little on that theme and to give a more detailed description of the gas industry's contribution towards making this year's exhibition even higher in quality than in previous years.

But first let us set the scene. As is well known, the Grand Hall at Olympia is the subject of an elaborate decorative scheme which receives considerable publicity. Fame and fortune attend the designer responsible for the scheme, and this year the lucky man is Malcolm Haylett, who in his first venture of this kind has provided an attractive likeness of London during the Regency period. Decorated balloons fly in the roof, and across the hall at the end directly opposite the main entrance is a terrace of Regency houses. By this terrace are the two major fuel sections, gas and electricity, occupying their usual positions on either side of the main gangway. Adjacent to the gas section, which consists of the Gas Council's stand and the stands of 12 appliance manufacturers, are the stands belonging to the makers of the solid fuel-fired equipment. Since in a number of cases the solid fuel concerned is coke, it can be said that gas and coke between them make a brave show indeed.

Colourful Kitchens

As reported last week, the theme of the Gas Council's pavilion (Stand 59) is 'The Happy Home,' and as we suggested, the predominating impression is one of colour. It was the colour that attracted the attention of Her Majesty The Queen on the occasion of her visit to the stand, in particular the colour scheme of one of the three different full-scale kitchens which constitute the stand's main feature. Colour plays a prominent part in planning the perfect kitchen, and so a bold use of colour is employed in each scheme; full details are shown with a plan of the house in which such a kitchen is situated. For instance, the large kitchen is presumed to have a north aspect, hence warm tones are employed. The cream fitments have soft red working tops. The walls, panelled in pale grey plastic, are united with a peach ceiling, and a soft gold and grey flecked flooring. The medium-size kitchen, with a sunny aspect, is in cool colours. The stainless steel unit tops meet pale green tiles which join yellow walls and a mauve ceiling. To compensate for a dull outlook, so often found in a small flat kitchen, ice-blue tiles and yellow ceilings have been used, while the cream fitments are topped with warm pink. This interest in colour has been echoed by the gas appliance manufacturers, and visitors have been struck by the unusual colour combinations used in a number of the gas appliances on show.

A part of the stand displays an attractive range of kitchen implements, and a small booklet lists the basic appliances, utensils and gadgets that a modern kitchen requires. In our view, this booklet is the one weak item in the whole exhibit, and we find it difficult to believe that even the most inexperienced housewife will regard as adequate the advice given about obtaining a bucket—'buy a good one'—or the advice that one should get pudding basins 'in assorted sizes.' Very different is the book compiled and edited for the Gas Council by the Good Housekeeping Institute, entitled 'The Happy Home.' We referred to this encyclopædia of household knowledge last week, and it is only necessary to add that visitors to the stand are placing orders for this beautifully produced 30s. volume.

So much for the Gas Council. We return now to the rest of the gas section. On Stand 48, Cannon (G. A.), Ltd., give a striking demonstration of how to sell a gas cooker. Like their stand at last year's Ideal Home, this one is designed less for display than for selling appliances, and a team of demonstrators point out the outstanding features of the A.125 cooker to passers-by without any request on the part of the visitor that they should do so. This is in contrast to the usual technique on gas stands, where little effort is made to

attract the visitors' interest other than by purely visual means.

At Stand 49 Radiation Group Sales, Ltd., display their 'New World' range of appliances to good effect. There are no really new appliances from this company for this exhibition, but the impressive range of cookers, space heaters, and water heaters is attracting considerable interest.

A New Water Heater

There is, however, an important new appliance on the next stand, Stand 50, where Sidney Flavel & Co., Ltd., hold sway. The 'National' No. 20 instantaneous water heater, which will shortly be in production, is a broken feed type heater with the working parts totally enclosed in a one-piece easily detachable steel case, finished in white or cream enamel. The burner consists of 12 jets which should not require attention in normal use, and an important feature of this heater is its easy maintenance, for, by the removal of a single knurled nut, the heat exchange unit can be unhooked and cleaned in less than five minutes.

On Stand 52 'Colour in the Kitchen' is demonstrated by Thomas De La Rue & Co., Ltd., where a G.4 and three 'Warwick' cookers show that the colours of cooking appliances need never be conservative. An outstanding new appliance on this stand is the 'Diplomat' gas boiler, which is just emerging from the experimental stage. As projected for sale it will incorporate new developments in thermostatic control, giving a guarantee of fully heated water at all times from five minutes after lighting. Other features of the design are its ease of maintenance, simplicity of operation, and neat appearance.

The Vulcan Stove Co., Ltd., on Stand 53, continues to meet the needs of the many housewives who like to see what is cooking. The glass-doored cooker has many adherents, and a particularly interesting exhibit on this stand is the prototype of a cooker to be called the 'Devon Royal.' This has the characteristic Vulcan glass door, but with a removable shielding metal plate which presumably prevents inquisitive visitors from peering into the oven. Another feature of this appliance is a new type of safety tap which may have a big future.

R. & A. Main, Ltd., on Stand 54, clearly believe in movement, since examples of their appliances revolve and open and shut their doors for the benefit of the passers-by. Pride of place goes to the No. 20 'Century' cooker which has achieved a great reputation during its comparatively short life, and the 32 refrigerator which is an important addition to the range of refrigerators offered by the industry. The Main series of water heaters and fires are also exhibited.

The 'Live Water' washing machine takes pride of place on Stand 55 where the Parkinson Stove Co., Ltd., are carrying out continuous demonstrations. The washing machine is too well known to require description in these columns, but mention might be made of the display background to the appliance, which by means of a waterfall and other aquatic effects, amply demonstrates the power of live water. An interesting innovation to be seen on this stand is the range of coloured taps for the 'Renown 5' cooker. These are now available in green, red, blue, cream or grey.

On Stand 57 Stoves, Ltd., show their 'Newhome' cookers against an attractive background of blue velvet drapes. Models on display include the No. X.2, the No. 286, and the compact 'Argyll' hotplate.

Ascot Gas Water Heaters, Ltd., have, on Stand 58, probably their most handsome exhibition stand for some years. Its attractions are too numerous to describe here, but mention might be made of the model housewife carrying a tray of tea-things, including a teapot which is being fed with hot water from the Ascot boiling water heater. The 715 balanced-flue multipoint is also heavily featured as well as portable fires, boiling rings, radiators, and 'Compoflex' gas tubing.

A neat device consisting of revolving saucepans and kettles emphasizes the virtues of the flat top hotplate of the 'Crusader' gas cooker shown by General Gas Appliances, Ltd., on Stand 60. Other features of this appliance are the double shelf plate-rack and 'clean line' oven. Also exhibited is the 'Junior General' cooker with two boiling burners or one boiling burner and grill.

On Stand 71 Ewart & Son, Ltd., exhibit their range of water heaters. An eye-catching feature on this stand is a heater the casing of which is raised mechanically to reveal the burners. On Stand 72 Bratt Colbran, Ltd., provide their usual faultless display of fires and fireplaces. In particular we noted the 'Bamburgh' convector radiant fire and the new 'Heaped' fire, a continuous burning grate of traditional design.

Solid Fuel Appliances

Among the exhibitors of solid fuel burning equipment we would mention the fine stand of Ideal Boilers and Radiators, Ltd. (which also includes their gas-fired boilers), Janitor Boilers, Ltd., on Stand 64, Newton Chambers & Co., Ltd., on Stand 68, where the new range of 'Redfyre' heating stoves may be seen, Trianco, Ltd., on Stand 73, and Sidney Flavel & Co., Ltd. popping up again on Stand 69 with a preview of the 'Cotswold' solid fuel cooker and their usual range of heating appliances.

Across the aisle on the electrical side is the British Electrical Development Association exhibit, 'The Magic of Electricity,' which is an assortment of mild conjuring tricks supported by an appliance display and one or two thought-provoking new features. Among these we particularly noted the so-called 'magic hotplate' which is temperature-controlled in such a way that the pan cannot boil over, and if it should boil dry, the switch automatically cuts out. Other items of interest on this stand are the combined refrigerator and water heater operating on the heat pump principle and the unusual scarlet Frigidaire. To our way of thinking, the basic error of this stand is the painful concentration of light at eye-level.

The Model Village

Traditionally, one of the principal attractions of the Ideal Home Exhibition is the display of full-size houses which go to make up what is usually termed the 'model village.' This year it is 'The Village on the Hill,' and consists of six houses, two bungalows, two blocks of flats and four shops. It is something of a triumph for the gas industry that gas appliances are heavily featured in almost all of these structures. The Davis house and the Berg 'Knowle' house, for example, have no less than ten gas appliances in each, and we have no doubt that the obvious choice of gas for exhibition in these 'ideal homes' is a fact which has been noted by visitors.

Another of this year's attractions is a kitchen designed by the Council of Scientific Management in the Home. This has been designed in the light of knowledge acquired during long and searching enquiry into the composition of the meals, their preparation and cooking, in modern homes throughout the whole of Britain. The committee responsible have based their design on the results of an almost microscopic enquiry which they carried out in connection with the Building Research Station of the Department of Scientific and Industrial Research. In view of the care taken to select the best possible equipment for such a kitchen, it is gratifying to note that a Parkinson 'Renown Five' cooker, an Electrolux LH.150 refrigerator, and a Dean A.1 gas-electric washing machine are included.

Another feature is the 'Family Doctor's Street of Better Living,' which is a large self-contained section where there are shops in which details of the nutritional and economic values of all manner of foods can be learned. Included in this section is a kitchen in which demonstrations are given to show how to conserve food values when cooking food. Among the appliances used we noted another 'Renown Five' cooker, an Astral refrigerator and a Ewart water heater. Other gas appliances are to be seen in use on stands throughout the exhibition, and this applies particularly to water heaters. In a sense, these appliances form an extension of the gas section itself, since they prove the fact that they have been selected by many well-known firms as being the most efficient means of providing hot water and other services on their stands.

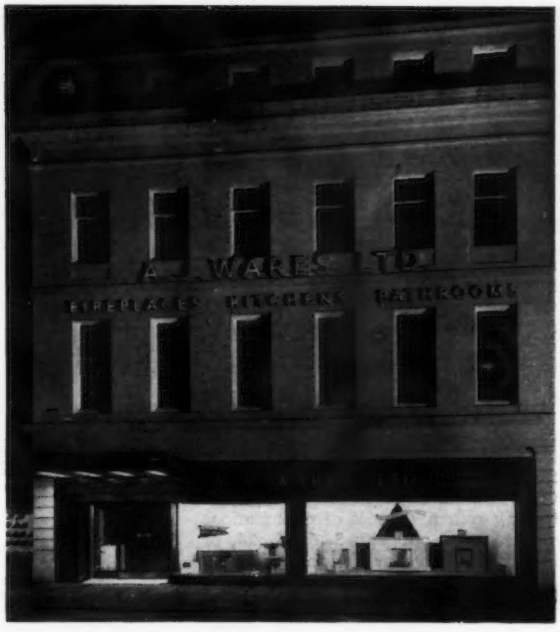
Summing up, it can be said that this year's Ideal Home Exhibition is probably the best ever advertisement for gas, and we believe that this opinion will be confirmed by those of our readers—and there must be many—who will visit the exhibition. At the present time, when competition is reaching a considerable degree of intensity, this showcase for gas must be a source of encouragement to us all.

A Fuel Display Centre at Newcastle-on-Tyne

Amply Equipped with Press Buttons and Signboards

A fine enterprise came to life last Friday, when Lady Isobel Barnett, of television fame, opened something new in the way of showrooms in Newcastle-on-Tyne. For that one day, competition between the fuel and power industries stopped. Present at the opening were the Lord Mayor of Newcastle, officials of the Gas and Electricity Boards, and Mr. Eric Bellingham, Director-General of the Coal Utilisation Council.

The basic idea is to have under one roof a complete display of gas appliances, electrical appliances, fireplaces, bathroom and kitchen equipment, many of them shown under working conditions where visitors can see for themselves the relative merits of gas, electricity, solid fuel, or oil in relation to cooking, heating, and water heating, and where they can receive expert advice. This idea is backed by A. J. Wares, Ltd., of South Shields, who for nearly 60 years have specialized in the supply of household equipment of all kinds, and who are accredited agents of the Northern Gas Board.



Exterior of the new showrooms to aid housewives and trade.

The gas section, with the Radiation whole house warming unit in action on coke.

The scope of the project is shown by the fact that the opening provided one of the comparatively few occasions when the heads of the gas and electricity undertakings and of the solid fuel industry are found on one platform and supporting the same cause.

In making the considerable investment involved in the new showrooms the Company has had in mind the facts that every householder wants the best possible equipment for his home; that there is a shortage of domestic help today which has given rise to an increased interest in labour saving devices; that the question of smog reduction and abolition is in everyone's mind at the moment, and also that there are throughout the country many houses which have not got a piped hot water supply or modern sanitary conveniences. The new Wares showroom brings together under one roof all the latest equipment likely to be needed by the housewife, local authorities, architects, the building trade, or landlords.

Occupying a central position in Hood Street, the new Wares showrooms may well set the pattern for further developments along similar lines in other parts of the country. The building has indeed been equipped in luxury style; modern décor and perfect lighting adding comfort to the eye and attraction to the wide range of appliances set out in the eight floors. One of our photographs shows the signboard to the different sections; another is of the gas section, with the Radiation whole house warming unit in action on coke.

A feature of the showrooms is the ample supply of press buttons which signal to a control room for a salesman, the idea being to let a customer range around and get some ideas before the high-pressure selling is turned on.

One of the signboards which enable visitors to find their way about without asking questions.

The Northern Gas Board has announced its intention of laying a 15 in. gas main from Stockton gasworks to Darlington works. Discussions are taking place between the Board and the local authorities regarding a suitable route.

Towards Business Efficiency

The Lord Mayor of Hull, Councillor H. W. Jackson, will open at the City Hall, Hull, on April 19, the Office Appliance and Business Equipment Trades Association's 163rd regional Business Efficiency Exhibition, the first to be held there since the war. The display will be relatively small, but some 42 firms are participating and a wide range of equipment, varying from furniture to intercommunication equipment and calculating and accounting machinery to simple office staplers and portable typewriters, will be on show.

Of topical interest is a new intercommunication system by Modern Telephones (G.B.), Ltd., which allows, the makers claim, an unlimited number of master stations to be included in a circuit, the wiring of which is such that cabling installation costs can be reduced by as much as 80%. In conjunction with the new system, a series of desk stations is to be tried out with 3, 6, 12, 24, or 48-way channels providing three different ways of inter-communication between stations with complete privacy for conversations between any two master stations or alternatively overall linking so that all can hear what is being said.

Also to be demonstrated will be the 'Pioneer' staff locator method of Communication Systems, Ltd., which introduces lamp indicators, each with the numerals 2-4-6 illuminated by means of a motorized controller to form simple codes of one, two, or three digits, thus providing a large variety of potential code signals. An advantage of this system is that it is silent and cannot be misunderstood because of varying sound interruptions going on at the same time, although audible warnings may accompany the lamps if desired. There are two types of signal indicator available.

Another interesting innovation will be the latest 'Rapidref' visible record binder by Percy Jones (Twinlock), Ltd., which will accommodate as many as 800 accounts in regular use. The system is operated from a multi-thonged central spine. From Byron Business Machines (John Jardine, Ltd.) comes an addition to the spirit duplicator range, the 'Polycopy,' a sturdy little machine which is efficient with any type of paper. The firm will also be showing its model '54' standard machine with 11 in., 15 in. and 19 in. carriages, all easily interchangeable, and its more portable typewriter with its finger-fitting keys.

Those who visited the recent Leicester exhibition will have seen the National Cash Register Company's new Class 158 accounting machine which was introduced there for the first time. This is an important addition to the range of automatic machines now available since it is of interest to the smaller firm than the majority cater for.

A new smaller-type Chubb standard safe is being shown for the first time, just over 3½ ft. in height, 29 in. wide, and 30 in. deep. Blowpipe and explosive resistant, it is claimed that it becomes increasingly difficult to open by any tool as increased resistance is met with as it penetrates the surface.

Fuel Efficiency Pays

The National Industrial Fuel Efficiency Service (N.I.F.E.S.) in conjunction with the Combustion Engineering Association, will hold a conference under the title of 'Fuel Efficiency Pays' on the second day of the third National Factory Equipment Exhibition at Earls Court on March 29. At the morning session starting at 10.30 a.m., Mr. John Rylands (E. Green & Son, Ltd.) will speak on 'Reducing Steam Raising Costs' and Mr. J. R. Wheating (W. H. Allen, Sons, & Co., Ltd.) will deal with 'Economics of Power Supply'. In the afternoon Sir Oliver Lyle (Tate & Lyle, Ltd.) is to speak on 'Steam Saving Pays', and Mr. L. W. Jenkins (Member of the Executive Council of the National Union of Manufacturers and Director of John Wright & Sons (Veneers), Ltd., and N.I.F.E.S.) will review 'N.I.F.E.S. Contribution to Fuel Efficiency'.

COMPANY NEWS

GLOVER & MAIN

The directors of Glover & Main, Ltd., propose, subject to Treasury consent, to increase the authorized capital of £1½ mill., sub-divide the existing £1 ordinary shares into 10s. shares, and make a 100% scrip issue.

RADIATION LTD.

Aggregate profits of the Radiation Group for 1954 were £1,439,109 gross, less £769,448 for taxation, making a net figure of £669,661. The corresponding figures for 1953 were £1,058,011 gross, less £636,785 for taxation, leaving £421,226 net. The Board decided on March 3 to recommend a final dividend of 11⅞%, making 15% for the year, against the 12½% paid in respect of 1953.

POWER-GAS CORPORATION

The annual report and accounts of the Power-Gas Corporation, Ltd., for the year ended September 30, 1954, show that after provision for tax and after deduction of appropriations in the subsidiary companies, the net profits in the accounts of the parent Company amounted to £203,920. A dividend of 14% leaves a balance of £39,727 to be carried forward. The Chairman, Mr. N. E. Rambush, in his statement circulated with the report, states that the group trading profit before charging depreciation and loan stock interest, at £760,289 is lower than last year's figure of £765,737. Nevertheless, the Directors are recommending an increase in the rate of dividend. Results show satisfactory progress, having regard to the temporary period of disturbance that accompanied the extension and equipment of the new South Works at Stockton. New specialities constantly engage the Board's attention. Certain features called for considerable expenditure on technical development and research during the year. Capital expenditure amounted to no less than £643,000 in the year; the major part related to new buildings, plant, and equipment.

Diary

March 12.—YORKSHIRE JUNIORS: Short Paper Day. 'Benzole Production,' T. Clegg; 'Iron Bacteria in Gasholder Water,' A. R. Mitchell; 'Appliance Reconditioning,' W. Voce. Wakefield.

March 12.—NORTH OF ENGLAND SECTION, I.G.E., and COKE OVEN MANAGERS' ASSOCIATION: Joint Visit to Howdon Gasworks, 2.30 p.m.

March 15.—LONDON AND SOUTHERN SECTION, I.G.E.: 'Distortion of Carbonizing Plant by Heat,' G. Dougill. 17, Grosvenor Crescent, S.W., 2.40 p.m.

March 15.—LONDON AND COUNTIES COKE SALES CIRCLE: Visit to Johnson's Works of Associated Portland Cement Manufacturers. (A second visit has been arranged for March 22.)

March 16.—SCOTTISH JUNIORS (WESTERN): Visit to R. & A. Main Ltd., Falkirk.

March 16.—LONDON JUNIORS: Visit to the Meteorological Office at Dunstable.

March 16.—EASTERN JUNIORS: Industrial Controls,' by a representative of Perl Controls, Ltd. Lowestoft.

March 17.—MIDLAND JUNIORS: Visit to Stafford Gasworks.

March 18.—SCOTTISH JUNIORS (EASTERN): Jubilee Dinner, Adam Suite, George Hotel, Edinburgh.

March 19.—WALES AND MON. JUNIORS (SOUTH): Joint Meeting with Western Juniors. Address by Mr. Gerald Nabarro, M.P. Cardiff.

March 22.—MIDLAND JUNIORS: 'Purification,' F. Grocott, Birmingham. 6.30 p.m.

March 25.—MANCHESTER AND NORTH OF ENGLAND SECTIONS, I.G.E.: Joint visit to Tingley Gasworks, followed by Centenary Dinner of Robert Dempster & Sons, Ltd., Elland, at Queen's Hotel, Leeds.

March 29.—NATIONAL INDUSTRIAL FUEL EFFICIENCY SERVICE and COMBUSTION ENGINEERING ASSOCIATION: Conference on 'Fuel Efficiency Pays' at National Factory Equipment Exhibition, Earls Court, 10.30 a.m.

March 31.—MIDLAND JUNIORS: President's Day at Wolverhampton.

March 31.—NORTH THAMES G.C.C.: Kent Room, Caxton Hall, Westminster, 2.30 p.m.

The National Coal Board is to erect plant for indirect cooling at the new £2 mill. coke oven plant at Fishburn (Co. Durham) to eliminate fumes. The Board states that tests have shown that there was no appreciable air pollution from the plant, but in view of representations by Sedgefield Rural Council on behalf of people living nearby, the Board has agreed to install plant to deal with the fumes.

MIDLAND JUNIORS VISIT AUDLEY ENGINEERING WORKS

A few of the visitors during their tour of the works.

One of the most interesting visits for some time was made by members of the Midland Juniors Gas Association on February 17, when they visited the works of the Audley Engineering Company at Newport, Shropshire. Since the war most of the Company's profits after payment of taxes have been used for the purchase of new machines, equipment, and buildings, and the result is that it has a modern factory, well-equipped, and of a high standard. Mainly engaged in the valve industry, the Company ranks as a medium-sized business, employing about 550 people.

Although the Company mainly makes valves it has, to the dismay of the Technical Director, Mr. E. B. Leach, some 1,200 items on its catalogue. The products are used in many industries, and at present 40% of its valves are sold overseas. Its technical experts and representatives travel extensively and Mr. K. M. Leach, Managing Director, who welcomed the party, was on his way shortly afterwards to Paris. The Sales Manager, Mr. J. Maxwell Laing, who acted as a guide, has recently returned from a 40,000 miles journey. His travelling took him only 23 days, enabling him to spend 73 days with agents and customers. Another guide was Mr. J. H. Attwood, Midland Representative, and well known to gas engineers in the area.

The Audley Engineering Company, under its present name, started in 1905. In 1909 the late Mr. R. W. Leach was appointed Chairman and Managing Director, and shortly afterwards Mr. N. B. Saunders, a present Director, joined the Company. Production of 'Audco' valves was started in 1922, but in those days they were rarely made over 3 in. and were simple in construction. During the 1939-45 war, like so many other companies, Audley turned out a variety of products, in addition to the main business of making 'Audco' lubricated valves, which were in very large demand for explosive factories, for 'Pluto' and 'Fido' and for hundreds of other applications.

The end of the war and reconversion to peace-time manufacture has found 'Audco' valves more in demand than ever, and the 'Audco Hypreseal' valve, developed before the war, but now in quantity production, is used for pressures up to 6,000 lb. per sq. in. This figure staggered the gas engineers present, to whom 50 lb. per sq. in. is high pressure. Flow production in the manufacture of valves is normally difficult, because of the large variety of valves produced, but at Audley a large degree has been possible and from the start of the tour the visitors were unanimous in the view that it was one of the finest and best laid out works of its type they had visited.

The raw material for the foundry is housed in a series of pens, so that each grade can be selected immediately when a charge is being made up. A recent introduction is a special mechanical charging unit, which feeds either one of two vertical cupolas in the foundry. The charge is loaded directly into the bucket of the mechanical charging unit, which in its loading position is situated with its top slightly above ground level and at a convenient height for tipping. It is electrically operated by push button, the bucket being raised and automatically tipped into the top of the cupola. The visitors were taken into the laboratory, where test pieces are taken during pouring and where the consistency and strength and other features of the sand can be checked.

The core shop was an example of what a core shop should look like, but seldom does. Sand is mixed at the end

Aerial view of the Audley Engineering Works at Newport, Salop.

of the shop and is loaded into buckets slung on to an endless monorail conveyor pass, each core making bench and readily accessible to the coremakers. The cores are transferred to the oven and from the oven to the stores by similar mechanical means. Finished castings are passed through wall hatches on roller conveyors to the fettling shop and thence by conveyors to the rough stores, which is adjacent to the machine shop.

In the machine shop the visitors saw the latest types of production labour saving machines and were told that some standard machines had been adapted to turn and bore the tapers in plugs and bodies. They also saw that each plug is lapped individually into its own body. The tool room was also inspected. In the packing department could be seen 18 in. gas valves marked for Melbourne, Australia. Other destinations marked on crates included Karachi and Amsterdam. 'Audco' valves have been used in most of the oilfields of the world; in Iraq, Venezuela, and Pakistan, to name but a few. The Company was naturally pleased when a number of its lubricated plug type valves were ordered for use on the South Wales Gas Grid.

After tea there was a short informal discussion, Mr. S. Brockbank (Newcastle-under-Lyme) and Mr. Arthur (South Staffs., Mond) asking several questions. These and others were answered by Mr. E. B. Leach and Mr. Attwood. Mr. H. J. Reynolds, President of the Association, in proposing the vote of thanks, was witty and brief. He paid tribute to the Directors and others who had planned the layout of the works and thanked the guides for so ably showing them round and answering all the questions asked them. Mr. E. B. Leach replied.

First Aid

A first-aid competition for units in the Sunderland Division of the Northern Gas Board was won by Hind Street Distribution Department, Sunderland, and they were presented with a silver challenge bowl which has been donated by Mr. W. O. Kirkwood, Divisional General Manager. Runners-up were Hendon gasworks, Sunderland, who received a silver cup. Durham Unit were third and Shotley Bridge works, Consett, fourth. The competition was open to all employees in the Division who hold the certificates of the St. John Ambulance Brigade. It is designed to encourage the men to take an interest in first aid and be prepared for any emergency which might arise. The competition, which brought an entry of 14 teams, is to be held annually, it was announced by Mr. Kirkwood, who presided at the finals. The awards were presented by Mrs. Kirkwood. The judge was Mr. D. L. Rennison, Chairman of the Sunderland Centre of the St. John Ambulance Association, of which Mr. Kirkwood has been elected a Vice-President.

PRESENTATION TO MR. W. MACNAUGHTON

At a meeting of the Midland Section of the Institution of Gas Engineers held at Birmingham on February 18, a presentation was made to Mr. W. Macnaughton, Chief Engineer and General Manager of the Wolverhampton undertaking, for his services as Chairman in the 1953-54 session. Mr. C. C. Wood, the present Chairman, who presided, said they would all remember Mr. Macnaughton's year of office for the interesting visits to Wolverhampton and the excellent entertainment which the members enjoyed there. They would also appreciate the extra effort he had made on behalf of the Institution Benevolent Fund, and he was so keen on benevolent work that he enabled the Section to contribute quite an appreciable sum over the average figure. Mr. Macnaughton had also served them as a member of the Institution Council, and had performed his duties to the great satisfaction of the members. Therefore he had great pleasure in asking him to accept on behalf of the officers and members of the Section a silver salver suitably inscribed.

Mr. Macnaughton, in acknowledgment, thanked the officers and members for what he described as 'a very nice gift,' and expressed his indebtedness to Mr. Wood for the kind things said about him. Whether they were true or not he would leave it to them to think about. However, he appreciated the gift, and it would be one of his major possessions, because it would remind him of the grand people he had worked with and their valuable and friendly co-operation. He could not have carried out his duties as Chairman without the able assistance of the then Secretary (Mr. J. Corrigan, now their Vice-Chairman), and the assistance which he had received from Mr. Wood and Mr. Allen (Warwickshire) General Manager) as his Vice-Chairmen during his year of office and he thanked all those members who had given him real support and made their efforts worthwhile.

The Secretary (Mr. D. K. Green, Coventry) announced the resignation of several members, either through retirement or removal, and three new members were also announced as follows: Mr. G. J. H. Hawkins, Divisional Distribution Engineer, Warwickshire; Mr. J. G. C. Waddell, Technical Assistant, and Mr. T. C. Watson, Carbonising Superintendent, Smethwick. The meeting endorsed the welcome given them by the Chairman.

At the outset the Chairman remarked that they were unfortunate in the choice of weather—there had been snowstorms all day on the previous day—and said the attendance was naturally affected thereby, especially as a lot of their members were busy making gas to cope with the extra demand. Unfortunately he had to report the loss to the Section since they last met of Mr. Alexander Tran, General Manager of the Northern Division of the Southern Gas Board, Chairman of the Section a few years ago and a member of the Institution Council. Mr. Tran was an extremely likeable and very courteous gentleman who was always ready to give others a helping hand.

Clayton Sports Dinner

The annual dinner of the Sports Association connected with Clayton, Son & Co., Ltd., was held on February 26, the Chairman being Mr. S. Clayton Thomson, Vice-President of the Association. The toast of the Association was proposed by Mr. I. Shuttleworth (President of the Leeds and District Cricket League), who congratulated the Association on its activities and, in particular, the cricket section on winning the championship of the Leeds and District Cricket League. Mr. S. C. Thomson replied, referring to the start of the Association in 1920, and the progress made over the past 35 years.

The toast of the guests was proposed by Mr. C. Brass, Vice-President, and responded to by Mr. Ron Crowther, Sports Editor, *Yorkshire Evening News*.

Trophies and prizes were presented by Mrs. S. C. Thomson, as follows: Cawthorne swimming trophy, and replica, Mr. T. Ripley; Hartley angling trophy, and replica, Mr. H. Lowe; Clayton golf trophy, and replica, Mr. W. E. Johnson, and runner-up prize Mr. J. Rathmell; Golf Section novices competition, winner, Mr. A. Warrington; runner-up, Mr. T. Garland. Best exhibit in Horticultural Section annual show to Mr. E. Lowe. Clayton batting trophy, and replica, for having won it three times, Mr. W. Newton. Baines bowling trophy, and prize, Mr. J. Gahan. Thomson fielding trophy, and prize, Mr. H. Higgins. Second team cricket section prizes, Mr. R. Peacock (batting), Mr. D. Long (bowling), and Mr. E. Thomas (fielding).

A Record Weekly Total of gas made available for public supply was reached in the North Western Gas Board area during the week ended February 27, when 2,241 mill. cu.ft. of gas was supplied, compared with the previous highest total of 2,200 mill. cu.ft. in the week ended February 7, 1954. Gas supplied during February amounted to 8,218 mill. cu.ft. and was up by 2% compared with 1954. In the 11 months of the current financial year a total of 77,595 mill. cu.ft. of gas has been supplied, an increase of nearly 4%.

London Juniors Visit Glover & Main

New Touring Technique Proved Successful

When 60 members of the London and Southern Junior Gas Association visited the factories of Glover & Main Ltd., at Gothic Works, Edmonton, recently, the guides were helped considerably by what might be described as a new 'factory touring technique.' For in many of the workshops visited had been arranged a carefully selected display giving detailed information and samples of the raw materials, tools used and the components produced by the departments.

The visitors, led by Mr. E. W. B. Dunning, President, and accompanied by Mr. J. D. Grant, Secretary, Mr. J. V. Rigg, Assistant Secretary and Mr. C. D. Shann, Past-President, were welcomed by Mr. C. Marley, Joint Managing Director of R. & A. Main Ltd., and Mr. D. Sime, Deputy Managing Director, Thomas Glover & Co., Ltd.

The tour was arranged so that as many departments as possible were seen in the individual factories on the 24-acre site.

First was shown a new Main colour film, 'Main Road to Cookery,' presenting the manufacture of the No. 20 'Century' cooker in story form.

Then the Juniors divided into groups. In the Thomas Glover meter factory, as for the rest of the tour, the route had been arranged so that the correct sequence of operations was seen, from raw material to final assembly, proving and testing. In the tin shop, which is one of the largest meter assembly shops in the country, accommodation is provided for 140 tinsmiths as well as other skilled craftsmen.

Members watch the assembly of a meter index in the Thomas Glover factory.

Next to be visited was the bright and spacious building which houses the Main Enamel Company's factory. The enamel frits and colouring oxides manufactured by this Company supply all the requirements of the Glover & Main group and are also in demand by many other manufacturers, both in Great Britain and overseas.

Touring the factory of R. & A. Main, the visitors saw the core shop and the floor foundry. This foundry, which has an area of 50,000 sq. ft., is used primarily for cored work and castings required in smaller quantities than would prove economic if produced in the mechanical foundry, which was the next department to be visited. In the fitting shop, attention was centred on the No. 20 assembly line where they were able to watch the making of these cookers from the assembly of the first panels to completion and final testing.

A visit to the R. & A. Main research block completed the tour. This building, opened in July, 1954, with its specially designed temperature-controlled and acoustically insulated rooms, is claimed to be one of the finest laboratories in the country for testing and development of gas appliances.

Lunch was taken at the Cooks Ferry Inn, where the party was formally welcomed on behalf of Glover & Main, Ltd., by Mr. Marley. At the end of the tour, the visitors were entertained to tea in the staff canteen. In proposing a vote of thanks to Mr. Marley and the Directors of Glover & Main, Ltd., for their hospitality, Mr. Dunning added a special word of praise for the guides who, he said, had made the tour highly instructive and entertaining. 'Everything has been carefully explained and the special displays arranged in the various departments have been most enlightening, allowing us to handle and examine the materials and components in various stages of production,' he said. 'We very much appreciate the efforts which have been made to ensure the success of our visit and extend our most sincere thanks.'

Replying, Mr. Marley said: 'We are always extremely pleased to welcome visitors to our works. In fact, we have always encouraged such visits, and we have felt that they are of great value to the industry as a whole. We are very happy to know that you so thoroughly enjoyed this tour and look forward with pleasure to welcoming you all again in the not-too-distant future.'

A guide explains the construction of 'London' cookers. Mr. Grant, Secretary, is third from left.

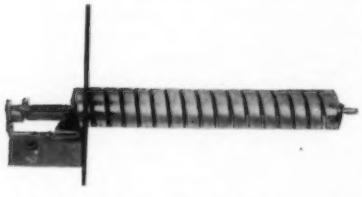
In the R. & A. Main research laboratory. Mr. Dunning, the President, is second from right.

TRADE NEWS

A new pressure element

A new range of pressure elements known as the 200 Series has been recently introduced by Foxboro-Yoxall, Ltd., and one of these—Type 250 heavy duty helical—is shown in the accompanying illustration. The extensive research which preceded its development was directed towards perfecting a manufacturing technique which would produce an element capable of measuring the very highest pressures with sustained accuracy, long life and high safety factors. Thus this new helical element, it is claimed, will measure pressures up to 80,000 p.s.i. higher than has hitherto been possible by mechanical means.

The element is built of a molybdenum bearing stainless steel, is said to have exceptional power and stability, and is



particularly suited to the measurement of continuously fluctuating pressures in the very high ranges. The corrosion resisting properties of the stainless steel also mean that 'Type 250' can be used in many applications where corrosive vapours may be present. Care has been taken to minimize the possibility of damage through over-ranging, and wide safety margins are provided. For example, an element for the range 0-10,000 p.s.i. may be over-ranged in safety to 18,000 p.s.i. A further feature is the provision of expanded scale reading, an element designed for 9-500 p.s.i. having a range from 9,000-10,000 p.s.i. with the result that the clarity and accuracy of the readings are improved.—*Foxboro-Yoxall, Ltd., Lombard Road, Merton, London, S.W.19.*

'Goodenough' pumps in Canada

An arrangement has been concluded between Goodenough Pumps, Ltd., of Twickenham, and Godfrey Engineering Co., Ltd., of Montreal, Canada, for the manufacture of the complete range of 'Goodenough' pumps in Canada and marketing throughout Canada and the United States. The pumps, which will incorporate American engines, will be sold under the trade mark 'Godfrey-Goodenough.' Sales in Canada and the United States in the past have been adversely affected by the lack of 'on the spot' spares and service facilities, which will now be provided by Godfrey Engineering Co., whose main works in Montreal comprise fully equipped machine shops, assembly shops, testing department and drawing offices, etc. These works were established in 1947 for the manufacture of aircraft cabin pressurization equipment and specialized ground servicing equipment similar to that produced by Sir George Godfrey & Partners, Ltd., of Hanworth, England, with whom the Canadian Company is affiliated.

Prototype pumps have already been produced in Canada, and full-scale production will be commencing within the next few months. Literature describing the complete range of 'Godfrey-Goodenough' pumps will be available shortly. British contractors undertaking civil engineering and public works projects in Canada are invited to apply for further information to *Godfrey Engineering Co., Ltd., 460, Metropolitan Blvd., Lachine, Montreal 32, Canada,* or to *Goodenough Pumps, Ltd., 70/72, London Road, Twickenham.*

Fire safety equipment

Two new fire-fighting appliances by the Pyrene Co., Ltd., are a CO_2 pressure operated dry-chemical extinguisher and a high expansion foam-making branchpipe.

The new 'Pyrene' PDU 25 dry-chemical extinguisher has been designed for speedier action in smothering fire outbreaks involving petrol, oils, alcohols, paints, and almost all kinds of industrial solvents. This extinguisher is operated in an upright position. It is especially effective against 'running' fires, where the flames are continually being fed by flowing inflammable liquids. The extinguisher contains 25 lb. of 'Pyrene' dry-chemical which is discharged under pressure provided by a cylinder of CO_2 gas. It is a smooth-flowing dry-chemical which will not 'cake' even in extremes of temperature and which will not deteriorate. Additional features claimed are that it is non-abrasive, non-corrosive and non-conductive of electricity.

Latest addition to the range of 'Pyrene' portable mechanical foam appliances is the new Model FB 10X foam-making branchpipe. This appliance gives the relatively high foam output of 1,000 gal. per minute at a water pressure of 60 p.s.i. and a water capacity of 100 g.p.m. using only 5 g.p.m. of 'Pyrene' standard foam-making compound. This is a development in fighting fires involving quantities of oils, spirits and other highly inflammable materials where the largest quantity of stable foam has to be produced from a given quantity of water such as that contained by water tenders or crash tenders. A special feature of this appliance is the 'Pyrene' dual-purpose 'Spray-Jet' attachment which enables the foam to be discharged in either a powerful jet or a 30 ft. wide spray by a simple movement of a control handle at the nozzle.—*The Pyrene Co., Ltd., 9, Grosvenor Gardens, London, S.W.1.*

'Yorkshire' fittings in copper

The recently-introduced 'Yorkshire' copper fittings are made from phosphorus deoxidized arsenical copper tube in accordance with B.S. 1174. Used with light gauge copper tubes, these are said to provide homogeneous pipelines which are particularly suitable for underground water supplies. But apart from their suitability for underground pipelines, they are also recommended for domestic water and gas services, low pressure

steam up to 15 lb. per sq. in., low pressure oil and air pipelines and vacuum pipelines. They comply with British Standard 864.

Like other 'Yorkshire' fittings, they are capillary fittings, incorporating, it is claimed, as an integral part of the fitting, the correct amount of solder for the simple and rapid making of sound, leak-proof and permanently reliable joints.

While only straight couplings are available at the moment, in $\frac{1}{2}$ in., $\frac{3}{4}$ in. and 1 in. British Standard sizes, further types such as tees and elbows will be available shortly.—*The Yorkshire Copper Works, Ltd., Leeds.*

New refractory coating

'Dohmseal' refractory coating is claimed by Mellor Mineral Mills, Ltd., to be capable of retarding the action of corrosive gases and of temperatures up to 1,800°C. It is supplied as a paste and is thus economical in use since the necessary water to form the slurry, which can be applied with a brush, is added by the user.

The paste form was decided upon rather than powder because in a paste the user is assured that the complete

(*Continued on page 674.*)

A luxury *all* can afford

The Paravector Gas Convector Heater is most efficient and economical and is £££'s cheaper than any other gas heater. Designed as a portable or fixed unit with non-aerated burners, a small constant pressure governor and fixed restrictor control. As a portable appliance the consumption is 6,000 B.T.U.'s per hour and as a fixed unit 8,000 B.T.U.'s per hour. Samples and price available now. Ample supplies for the heating season. Overall dimensions: height 30", depth 11¾", width 19". Finish: attractive hammered golden bronze with brown stove enamelled grille.

PARKINSON

PARAVECTOR

ANOTHER HIGH QUALITY GAS APPLIANCE BY THE MAKERS OF THE FAMOUS **RENOWN** AND **PARAGON** COOKERS.

THE PARKINSON STOVE CO. LTD., STECHFORD, BIRMINGHAM 33 · *A member of the Parkinson & Cowan Group*

FAULTLESS PERFORMANCE

FLAWLESS APPEARANCE...

As the expert diver's faultless performance and flawless appearance delight the critical spectators, so the faultless performance and flawless appearance of the Century Cooker delight the critical housewife . . . as perfect diving is the result of years of training and practice so the Century is the result of R. & A. Main's years of experiment and research.

Always to the forefront in improving the efficiency of the gas cooker, R. & A. Main Ltd. have been "first in the field" with many outstanding features . . . in 1922 Main introduced the simplified form of cooker construction . . . in 1927 Main were first with an all-enamelled cooker . . . and in 1935 Main introduced the first all-sheet metal cooker.

The No. 20 Cooker was the first chassis-less model to be produced and marketed in Britain, and it was also the first cooker to incorporate an oven-flue vent discharging in front of the backplate. The high efficiency and popularity of the Century has indeed proved the worth of Main's years of constant research.

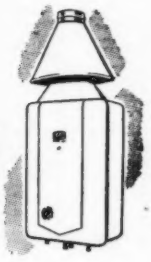
MAIN No. 20 CENTURY GAS COOKER

C2

Note the name-made by MAIN

R. & A. MAIN LIMITED
LONDON and FALKIRK

there is a MAIN water heater for every domestic purpose . . .

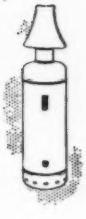


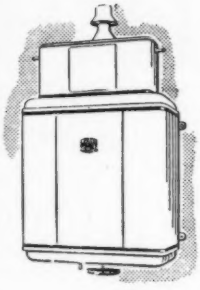
instantaneous for a complete household service . . . the M.I. Multipoint

instantaneous for the bath . . . the New Junior

instantaneous or storage

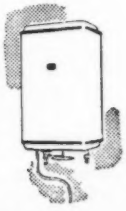
for a complete household service . . . the G.L.C. Circulator





storage for a complete household service . . . the Thermain No. 15

storage for the sink or lavatory basin . . . the Thermain No. 2



MAIN WATER HEATERS Ltd.

Gothic Works, Thornton Rd., Croydon Surrey
W13

Continued from page 670

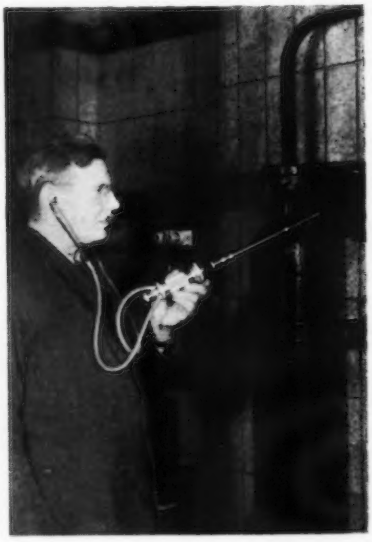
mixing of the materials achieved in manufacture remains.

This new refractory coating can also be used for jointing when mixed with clay grog and produces effective repairs of broken brickwork. Fired at 700°C.-1,000°C. 'Dohmseal' forms a satisfactory refractory coating in a few hours.—*Mellor Mineral Mills, Ltd., Etruria Vale, Stoke-on-Trent.*

'Airsonic' industrial stethoscope

The diagnosis of sickness, it might be said, is largely connected with the early use of the medical stethoscope and physical breakdown has been prevented by its early and timely use.

A remarkable instrument known as the 'Airsonic' industrial stethoscope has been brought to our attention which brings to the aid of the engineer a similar means of diagnosis, novel, distinct and simple. This instrument claims to facilitate the inspection and testing of the internal condition of all moving machinery while under load, without any break in production, or interference



A Continental picture of the 'Airsonic' industrial stethoscope in action.

in workshop practice. Loss of pressure —gas, chemical, steam, water or air— can also generally be traced to its source.

The apparatus incorporates a solid metal body, one end of which is hollowed out to form the bottom of a resonance cavity, while a closing disc, acting as a valve, limits the resonance cavity outwards. The capacity is adjustable during soundings, by means of a manually-operated screw, so that the volume can be adapted to the frequency of the sound to be detected. By use of the frequency regulator incorporated in the instrument it is truly possible to 'tune-out' and 'tune-in.'

The instrument is said to have many possible applications in the gas industry, and is already being used successfully by the gas industries on the Continent. In this country hundreds of firms throughout industry are finding the stethoscope of increasing importance for routine inspection and maintenance generally.

Among some prominent users are the armed services and the Atomic Energy Research Establishment. Millions of television viewers have seen the stethoscope illustrated in the recent programme 'Science Review' (No. 32), which described industrial stethoscopes generally.—*The Murchie Trading Co., Ltd., 11, Kings Road, Sloane Square, London, S.W.3.*

Leak detector

Said to show the position of gas leaks, no matter how small, 'Foliac' leak detector solution is a new product of simple operation.

The process is as follows: Remove the stopper from the jar containing the solution. Attached to the stopper is a dauber. Wipe this round the joint or anywhere a leak is suspected. The leak will reveal itself by bubbling, say the makers. Bottled gas users have apparently received the product well.—*Graphite Products, Ltd., Battersea Church Road, London, S.W.11.*

Extended PTFE rod and tube

Crane Packing, Ltd., has just completed the design and construction, in their own works, of special plant and equipment for the extrusion in substantial quantities, to exact and uniform standards of quality, of the plastic polymer Polytetrafluoroethylene (PTFE).

This plant and equipment, which is now in continuous daily operation, for the first time makes practicable the extrusion of PTFE rod and tube up to an external diameter of 4 in. PTFE tube of this diameter has a minimum wall thickness of ¼ in., and the standard length into which both rod and tube will be supplied is 3 ft. Other lengths can be supplied to special order, providing the quantity required is sufficient to justify such orders being undertaken.

The actual minimum diameter of both PTFE ¼ in. rod and tube is ⅜ in. outside diameter, and from that size up to 1½ in. outside diameter, and it is practicable to extrude almost any continuous length that is likely to be required.

In developing this equipment, and the techniques by means of which satisfactory extrusion up to these sizes can be made, the makers say they have also had regard to certain idiosyncrasies of the material, notably its 'memory characteristics.'

The tendency for PTFE fabrications to return, in certain conditions, to previous basic forms—a phenomenon well known to users of PTFE—is said to be eliminated by this new extruded technique. The entire process is conducted under the most strictly applied controls and the uniformity of production is maintained irrespective of the quantity.

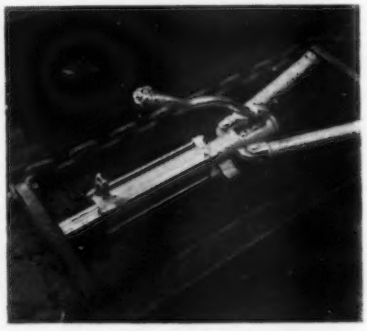
Two grades of the material are supplied in rod and tube form; one, the 'standard' grade, the other a special high grade, possessing exceptional electrical properties.

In addition to producing a wide range of fabrications in the material, the Company is also able now to consider more complex applications and by arrangement it will undertake research into new uses of the material on behalf of companies which are interested in developing the design of equipment.—*Crane Packing, Ltd., Slough, Bucks.*

Portable flight-bar straightener

A new portable hydraulic tool intended for straightening damaged conveyor flight-bars without removing them from the conveyor, has been introduced by A. G. Wild & Co., Ltd.

Weighing only 43 lb. in working order, the tool incorporates a hydraulic ram manually actuated, capable of exerting



a pressure of five tons. Collapsible legs are used to form a brace, and a screwed socket is incorporated in the end of the body to take special adaptors if required. The piston is self-returning.

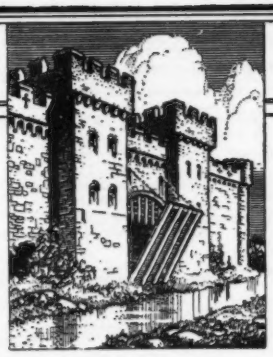
The photograph shows a sequence in the operation, the whole of which can be carried out in a few seconds.—*A. G. Wild & Co., Ltd., Sheffield.*

Centrifugal paddle blade fans

A new and improved design of paddle blade fan is claimed by Matthews & Yates, Ltd., to permit easy changes of discharge direction and/or rotation on site, and to reduce work in the drawing office. The new fan is available in 11 sizes from No. 4 to No. 14 and to effect the change it has a symmetrical casing and interchangeable side cover plates.

These vee-rope driven paddle blade fans, series 4D, are built to two driving arrangements. Fans built with the first arrangement are for the lower duties and have fitted to the side of the fan a cast-iron bracket which houses the ball-bearings and the shaft. Fans built with the other driving arrangement are for heavier duties and higher pressures and are supplied with a separate cast-iron bearing stool, ball or ring oiling bearings and heavier shaft.

The fans are also supplied with direct-coupled driving arrangements, and for the infrequent occasions when special angular discharges are required.—*Matthews & Yates, Ltd., Cyclone Works, Swinton, Manchester.*



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Specialists in the repair of Reinforced Concrete Structures, etc.

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LININGS FOR STEEL BUNKERS.

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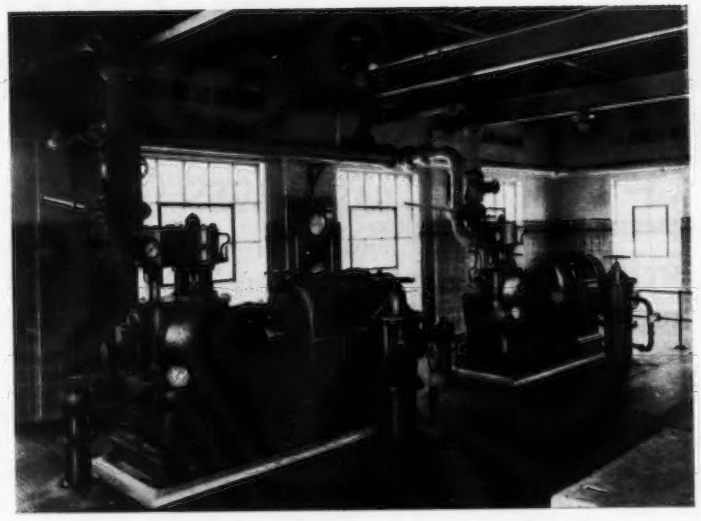
SISSON STEAM ENGINES

FOR LONG PERIOD CONTINUOUS RUNNING

DESIGNED for driving EXHAUSTERS BOOSTERS COMPRESSORS ETC.



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SUITABLE for GAS GOVERNOR or AUTOMATIC CONTROL

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THOMAS BAYLEY (GREAT BRIDGE) LTD.
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Manufacturers of Best Staffordshire Blue, Brown and Red Engineering Bricks
Blue pressed and Wirecut Paviors for Hopper Linings and Retort House Floors

COMPRESSORS & EXHAUSTERS FOR AIR AND GAS.
See our Advertisement Next Week.
REAVELL & CO. LTD. IPSWICH.

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India-Rubber and Airproof Manufacturers and General Contractors.
LARGEST MANUFACTURERS OF GAS MAIN BAGS.
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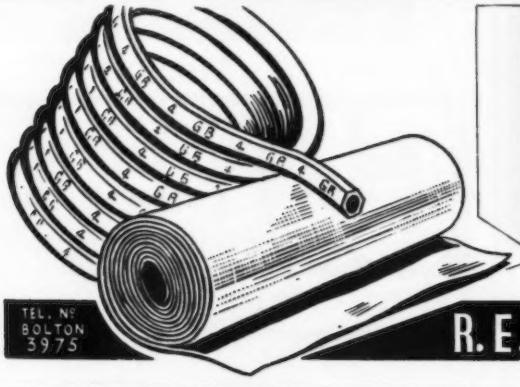
Contractors to H.M. Government

Gas Bags for Repairing Mains
PATENTEES OF THE **DENMAR BAG**
Impervious to Main Liquor and Climatic Influences.

Round or Cylinder Shape.

Pull-through and Expanding MAIN STOPPERS.
All types of INDIA-RUBBER BOOTS.
DRAIN RODS AND WHALE-BONE BRUSHES.
HOSE AND TUBING FOR ALL PURPOSES.

Stokers' Mitts and Gloves of every description.
Contractors' & Miners' Woollen Jackets, Trousers, Hats, &c. **244, Goswell Road, LONDON, E.C.1.**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SHEETING
WATER, WASTE
GAS & SOIL PIPES
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Now being issued in 10 self-contained sections. Sections available, and prices, as below :

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OTHER SECTIONS IN ACTIVE PREPARATION.
FROM
WALTER KING, LTD. 11, BOLT COURT, FLEET STREET, LONDON, E.C.4.

PUBLISHERS' NOTICE

The " Gas Journal " is published every Wednesday, price 1/3d.; by post 1/5d.

Subscription Rates: Home and Empire:—52/- per annum; Foreign:—60/- per annum. (Both payable in advance.) A copy of the " Gas Journal " Calendar & Directory is presented each year to continuous subscribers.

Classified Advertisements: All small classified advertisements are charged at 2/- per line (approx. 7 words)—minimum charge 10/-. A Box Number address occupies 2 lines, and a further 6d. is charged towards cost of postage on replies. Copy must be received by first post on Monday to ensure insertion in that week's Journal.

Displayed Advertisements: Rates obtainable on application to the Business Manager. Change of copy for displayed spaces must be received 14 days prior to publication if proofs are required. Type area of inside pages 10 in. deep × 7 in. wide; block screen 120.

BUSINESS MANAGER: S. T. CULLEN

MIDLANDS MANAGER: G. B. Torrance, 42, Wychall Lane, King's Norton, Birmingham, 30. *Telephone:* Kings Norton 3868

NORTHERN MANAGER: Philip W. B. King, Flat 1, 7 Langcliffe Avenue, Harrogate. *Telephone:* Harrogate 67625.

SOUTHERN REPRESENTATIVE: A. Engelhardt, 11, Bolt Court, Fleet Street, E.C.4. *Telephone:* Central 2236-7

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SPECIALLY ACTIVATED OXIDE OF IRON

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GAS PURIFICATION & CHEMICAL COMPANY LIMITED
ESTABLISHED 1873
PALMERSTON HOUSE, BISHOPSGATE, LONDON, E.C.2.

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FIRE FIEND v. NU-SWIFT

All Fire Extinguishers look alike. Please tell us why NU-SWIFT are so much better—BEFORE IT IS TOO LATE!

Name.....
Address.....
Post NOW to Nu-Swift Ltd. 25 Piccadilly W.1.
—AHEAD OF THE FIRE FIEND'S VISIT!

In Every Ship of the Royal Navy

"KLEENOFF" *
THE COOKER CLEANER

"KLEENOFF"
FIBRE BRUSHES
RUBBER MOPS

"KAY-DEE" *
KETTLE DESCALER

** for resale to the public, and in bulk for works use.*

BALE & CHURCH, LTD.
7, CROMPTON WAY, CRAWLEY, SUSSEX

APPOINTMENTS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order, 1952.

SCOTTISH GAS BOARD

LANARKSHIRE DIVISION
SENIOR ENGINEERING ASSISTANT

APPLICATIONS are invited from suitably qualified persons for the position of SENIOR ENGINEERING ASSISTANT. The party appointed will be responsible for the planning and execution of all plant installations, buildings and reconstruction within the Division and should have had previous experience in work of a similar nature.

Applicants should possess an Engineering Degree or equivalent in Civil or Mechanical Engineering, and preferably be a Corporate Member of the Institution of Gas Engineers.

Salary will be in accordance with A.P.T. 11—£740-£865—of the National Scale of Salaries for Gas Staffs, with placing according to experience and qualifications.

Applications stating age, qualifications, present position and previous experience, together with the names of two referees to reach the undersigned in a sealed envelope endorsed 'Senior Engineering Assistant' not later than Monday, April 4, 1955.

JAMES M. DOW,
Divisional Controller.

Divisional Offices,
Bothwell Road,
Uddingston.
March 1, 1955.

SCOTTISH GAS BOARD

EDINBURGH DIVISION
EDINBURGH DISTRICT
GASFITTING SUPERINTENDENT

APPLICATIONS are invited for the position of GASFITTING SUPERINTENDENT in the Edinburgh District. Applicants must be experienced in all branches of gas utilisation, appliance installation and maintenance. Sound training and experience in the planning of work, preparation of estimates and supervision of gasfitters is essential.

The salary will be within Grade A.P.T. 12, Provincial 'A', £790/£915 per annum with placing according to qualifications and experience. The post is superannuable and the successful candidate may be required to pass a medical examination.

Arrangements are being made for the provision, in the near future, of a modern dwelling house to be let to the successful candidate at a reasonable rental.

Applications stating age, qualifications and experience, together with the names of two referees, should be addressed to the undersigned on or before Wednesday, March 23, 1955.

DAVID BEAVIS,
Divisional Controller.

Scottish Gas Board,
Edinburgh Division,
15, Calton Hill,
Edinburgh, 1.

SCOTTISH GAS BOARD

DUNDEE GROUP

APPLICATIONS are invited for the position of JUNIOR TECHNICAL ASSISTANT LABORATORY, with the Dundee Undertaking of the Scottish Gas Board. The Salary applicable to this post will be within A.P.T. Grades 1-6 (£185-£610 per annum) with placing according to experience and qualifications. School Leaving Certificate or equivalent is essential. Applications, stating age, training, experience and qualifications together with any Testimonials should be lodged with the undersigned within 10 days of the appearance of this advertisement.

W. S. JOHNSTON, B.Sc.,
Group Manager.

Gas Works,
50, East Dock Street,
Dundee.

EASTERN GAS BOARD

WATFORD DIVISION
APPOINTMENT OF DEPUTY ENGINEERING (CRAFTS—INCLUDING ELECTRICAL) FOREMAN—LUTON WORKS

APPLICATIONS are invited for the above post. Applicants should be between the ages of 30 and 40 years and preferably have experience of general mechanical and electrical maintenance work in a large gas works, besides the ability to direct and supervise skilled craftsmen.

The successful applicant's salary will be within Salary Grade A.P.T. 6 of the Agreement of the National Joint Council for Gas Staffs ('Fringe' Met.—£550 to £630 per annum).

The person appointed may be required to pass a Medical Examination and, unless already subject to a Pension Scheme by virtue of the Gas (Pension Rights) Regulations 1950, will be required, if eligible, to join the Board's Staff Pension Scheme within six months from taking up the appointment.

Applications should be made in writing to the undersigned not later than March 26, 1955.

R. SUMMERSON,
Works Engineer.

Gas Works,
Dunstable Road,
Luton, Beds.

EASTERN GAS BOARD

IPSWICH DIVISION
INDUSTRIAL GAS ENGINEER

APPLICATIONS are invited for the position of an INDUSTRIAL GAS ENGINEER in the Ipswich Division. Applicants should have had experience in the design, construction and installation of industrial and commercial plant covering a range of representative industries. Duties will include contacting Industrialists in the Division and carrying out surveys, etc.

The commencing salary will be within Grade A.P.T. 12, Provincial 'A' (£790-£915) and the initial placing on the Scale will be according to experience and qualifications.

The successful candidate may be required to pass a medical examination, and unless already subject to a pension scheme, by virtue of the Gas (Pension Rights) Regulations, 1950, will be required, if eligible, to join the Board's Staff Pension Scheme within six months from taking up the appointment.

Applications stating age and giving full particulars of education, training and qualifications and experience, should be sent not later than March 26, 1955, to the General Manager, Ipswich Division, Eastern Gas Board, Crane Hill Lodge, London Road, Ipswich, Suffolk, endorsed 'Industrial Gas Engineer'.

(Classified advertisements continued on page 678)

APPOINTMENTS VACANT (ctd.)

A GAS ENGINEER is required for a term of approximately 12 months in connection with the distribution of Natural Gas in West Pakistan. Candidates should be capable of supervising the installation, adjustment and maintenance of all metering and regulating stations and the repair of meters and regulators. Salary according to qualifications and experience but will not be less than Rs.(Pak.)1,500 per month (approx. £161 Stg.) with free board and accommodation. Applications with full details should be made in writing to Box G.J.980, *c/o* 191, Gresham House, E.C.2.

VACANCIES will occur in the near future for men suitable for employment as TECHNICAL OFFICERS to the Coke Distributors' Associations. Commencing salaries will be in the region of £800 and will depend on the qualifications, experience and ability of the candidates chosen.

Applications should be made in writing stating name, age, technical qualifications and experience, and be accompanied by the names of two referees, and should be sent to the Executive Officer, National Federation of Coke Distributors' Association, Terminal House, 52, Grosvenor Gardens, London, S.W.1, by March 15, 1955.

NORTH WESTERN GAS BOARD

FYLDE GROUP

DISTRICT SERVICE MANAGER—

BLACKPOOL DISTRICT

APPLICATIONS are invited for the above pensionable appointment at a starting salary of £1,200 per annum.

The person appointed will be responsible to the Group General Manager for consumer service within the Blackpool area including the control of showrooms with their Sales and Administration Staffs. He will also be responsible for the Central Meter Repair and Appliance Reconditioning Workshops, together with the operations of gas installation and maintenance staffs covering Blackpool and its contiguous districts of Poulton-le-Fylde, Thornton Cleveleys and Kirkham.

Detailed applications, giving the names of two referees should reach the Group General Manager, N.W.G.B. (Fylde Group), Princess Street, Blackpool, within fourteen days.

EAST MIDLANDS GAS BOARD

LINCOLNSHIRE DIVISION

DRAUGHTSMAN—GRIMSBY GROUP

A VACANCY EXISTS at Grimsby for a DRAUGHTSMAN, preferably with experience in steel structures, foundations, pipework and plant lay-out. The commencing salary will be within Grades A.P.T. 6/7 of the National Salary Scales for Gas Staffs (£530-665) according to experience and qualifications.

The position is pensionable and the successful applicant will be required to pass a medical examination.

Applications stating age and giving details of qualifications, education and experience and the names of two referees should be addressed to the Group Manager, East Midlands Gas Board, Sheepfold Street, Grimsby, to arrive not later than March 19, 1955.

BERNARD CLARKE,
Divisional General Manager.

Lincoln.
March 4, 1955.

WEST MIDLANDS GAS BOARD

NORTH STAFFORDSHIRE DIVISION

SECTION HEAD,

DIVISIONAL INCOME SECTION

APPLICATIONS are invited for the above post located at Hanley, Stoke-on-Trent.

Applicants should have a sound practical knowledge of Consumer accounting, including mechanised systems, preferably in a Public Utility Undertaking.

The person appointed will be responsible to the Divisional Accountant for the organisation and control of centralised billing and accounting for all consumers' accounts including hire purchase.

The salary for the post will be within Grade 11 (£740-£865 per annum) of the National Salary Scales for Gas Staffs.

The post is pensionable and the successful candidate may be required to pass a medical examination.

Applications, stating age, qualifications and experience, together with the names of two referees, should be addressed to Mr. J. E. Stanier, Divisional General Manager, West Midlands Gas Board, North Staffordshire Division, Etruria Gas Works, Stoke-on-Trent, to reach him within fifteen days of the appearance of this advertisement.

J. C. INGRAM,
Secretary to the Board.

THOMAS GLOVER & CO., LTD.

REQUIRED, REPRESENTATIVE not above 40 years of age. When replying give full details of education, general qualifications and salary expected.—Sales Director, 48 Grosvenor Gardens, S.W.1.

WALES GAS BOARD

PONTYPOOL UNDERTAKING

SHIFT SUPERINTENDENT

APPLICATIONS are invited for the position of SHIFT SUPERINTENDENT at the above Undertaking. Candidates should preferably have had experience on Woodall-Duckham Continuous Vertical Retorts, and should have had technical training in all gas works ancillary plant and equipment.

The Salary will be within Grade A.P.T. 6—of the National Council for Gas Staffs—Provincial 'A' £530-£610 per annum, plus housing accommodation, rent free. The successful candidate will be required to pass a medical examination and subscribe to the Board's Superannuation Scheme.

Applications, stating age, technical qualifications and experience, together with the names of two referees to be received by the undersigned not later than March 21, 1955.

A. FACER,
General Manager.

Wales Gas Board,
Pontypool Undertaking,
Gas Offices,
Hanbury Road,
Pontypool, Mon.

WALES GAS BOARD

ENGINEERING DRAUGHTSMAN

APPLICATIONS are invited for a mechanically trained DRAUGHTSMAN. Experience in preparation of drawing in connection with pipe laying schemes and possession of National Certificate in Mechanical Engineering or equivalent qualification would be an advantage.

Salary in accordance with qualifications and rising to £610 per annum.

If required a semi-detached house with garage can be provided in Rhyl, North Wales, at a reasonable rental, on a service tenancy agreement.

All applications received by the undersigned before March 18, 1955, will have every consideration. Interview expenses will be paid.

The successful applicant will be required to pass a medical examination and contribute to the Board's Superannuation Scheme.

O. P. CRONSHAW,
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Wales Gas Board,
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PLANT FOR SALE

BOILERS FOR DISPOSAL EX STOCK

ECONOMIC

Hudson Patent Economic Boiler 18ft. long × 8ft. 6in. dia. with two side banks of tubes each 24ft. long × 4ft. 8in. dia. Working pressure 150 lbs. per sq. inch. Evaporation, 14,000 lbs. per hour.

Paxman, horizontal, economic multitubular Boiler 14ft. long × 8ft. 7in. dia. × 160 lbs. working pressure. Evaporation approx. 7,990 lbs. per hour from feed at 212° F.

LANCASHIRE

One—24ft. long × 9ft. dia. × 190 lbs. working pressure. Hand fired.

One—21ft. long × 7ft. 6in. dia. × 100 lbs. working pressure. Hand fired.

VERTICAL

Blake, vertical, multitubular, coal fired, 17ft. 6in. high × 7ft. dia. × 160 lbs. working pressure. Evaporation approx. 3,000 lbs. per hour.

Cochrane No. 10 vertical multitubular, coal fired, 12ft. 3in. high × 5ft. 6in. dia. × 100 lbs. working pressure. Evaporation approx. 1,620 lbs. per hour.

Vertical coal fired, cross tube, 12ft. × 6ft. × 100 lbs. working pressure.

Vertical coal fired, cross tube, 8ft. 6in. × 4ft. × 100 lbs. working pressure.

Vertical coal fired, cross tube, 8ft. 5in. × 4ft. 6in. × 120 lbs. working pressure (new).

Vertical coal fired, cross tube, thimble tube, 8ft. × 3ft. 9in. × 80 lbs. working pressure.

Vertical coal fired, cross tube, 7ft. 6in. × 4ft. × 100 lbs. working pressure.

Cochrane, vertical, coal or gas fired, hot water Boiler 6ft. × 3ft.

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H.P.	Make	Enclosure	R.P.M.
144	G.E.C.	... Screen Prot.	... 730
55/30	L.D.C.	... Prot. ... •	... 960/720
35	B.E.P.	... Prot. ...	... 1450
35	Higgs ...	... Screen Prot.	... 730
35	Harland...	... Prot. ...	... 720
30	Metro-Vick.	... Prot. ...	... 750
25	L. Scott.	... Prot. ...	... 960
25	MacFarlane	... Screen Prot.	... 750
25	Metro-Vick.	... Prot. ...	... 725
22	B.T.H.	... T.E. ...	... 1470
22	McGhee	... Screen Prot.	... 965
20	Bull ...	... Screen Prot.	... 1440
20	L.D.C.	... Screen Prot.	... 1440
20	MacFarlane	... Screen Prot	... 750
19	E.E.C. ...	... T.E. ...	... 1460
18	Brooks ...	... T.E. ...	... 1430
17½	Bull ...	... Screen Prot.	... 1440
17	L.D.C.	... T.E. ...	... 1440
14	Crompton	... Screen Prot.	... 1430
16	Sturtevant	... T.E. ...	... 770
15	Brooks ...	... Screen Prot.	... 1580
15	Higgs	... Screen Prot.	... 1460
15	Metro-Vick.	... Screen Prot.	... 1460
15	Bull ...	... Screen Prot.	... 1440
15	Verity ...	... Screen Prot.	... 1440
15	Westinghouse	... Prot. ...	... 1410
15	E.E.C. ...	... Screen Prot.	... 960
15	Brooks ...	... Screen Prot.	... 960
15	Peebles ...	... Screen Prot.	... 940
15	E.E.C. ...	... Screen Prot.	... 725/900
15	Brooks ...	... Screen Prot.	... 750
15	E.E.C. ...	... Screen Prot.	... 720
15	E.E.C. ...	... Screen Prot.	... 570
13½	E.E.C. ...	... T.E. ...	... 1465
12½	Brooks ...	... T.E. ...	... 1440
12½	E.E.C. ...	... Screen Prot.	... 955
12½	E.E.C. ...	... Screen Prot.	... 720/575
12	Crompton	... Screen Prot.	... 725
12	Brooks ...	... Screen Prot.	... 720
10	Crompton	... Screen Prot.	... 1440
10	Harland...	... Screen Prot.	... 930
10	Brooks ...	... T.E. ...	... 960
10	E.E.C. ...	... Screen Prot.	... 715
10	Harland...	... Ventilated	... 680
10	E.E.C. ...	... Prot. ...	... 570/720
10	E.E.C. ...	... Screen Prot.	... 565
8	Brooks ...	... T.E. ...	... 1450
8	Harland...	... Screen Prot.	... 1440
7½	Brooks ...	... Screen Prot.	... 950
7½	E.E.C. ...	... Screen Prot.	... 715
7	E.E.C. ...	... Prot ...	... 470
6	E.C.C. ...	... Prot. ...	... 710
5½	L. Scott.	... Screen Prot.	... 1430
5	A.C.E.C.	... T.E. ...	... 1440
5	E.E.C. ...	... Screen Prot.	... 950
4½	Metro-Vick.	... F.L.P. ...	... 975
4	B.T.H.	... Screen Prot.	... 955
3½	Crompton	... Screen Prot.	... 1430
3	Brooks ...	... T.E. ...	... 3000
3	Howell	... T.E. ...	... 1755
3	B.T.H. ...	... Screen Prot.	... 1420
2½	Stamford	... Vent. ...	... 1450
2½	Brooks ...	... T.E. ...	... 1440
2	B.T.H.	... Screen Prot.	... 1420
2	Crompton	... Screen Prot.	... 940

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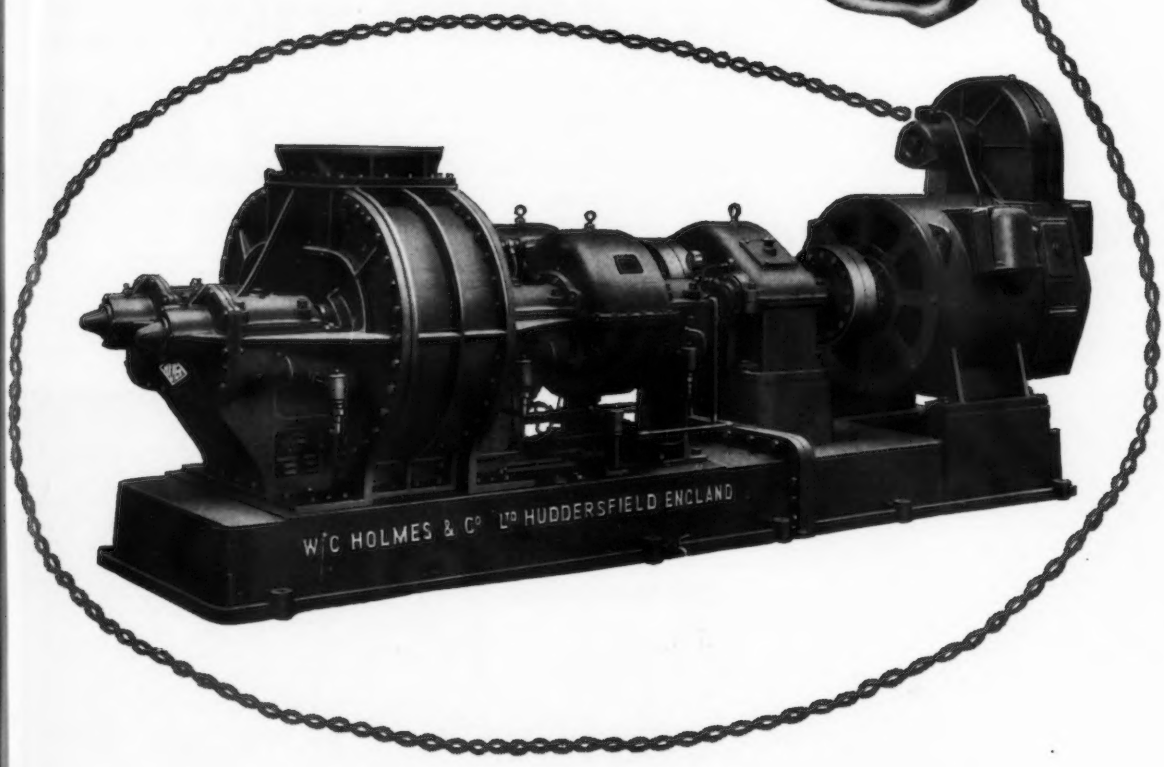

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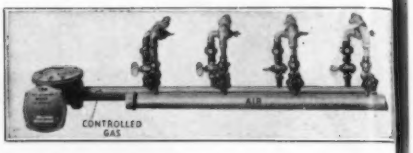

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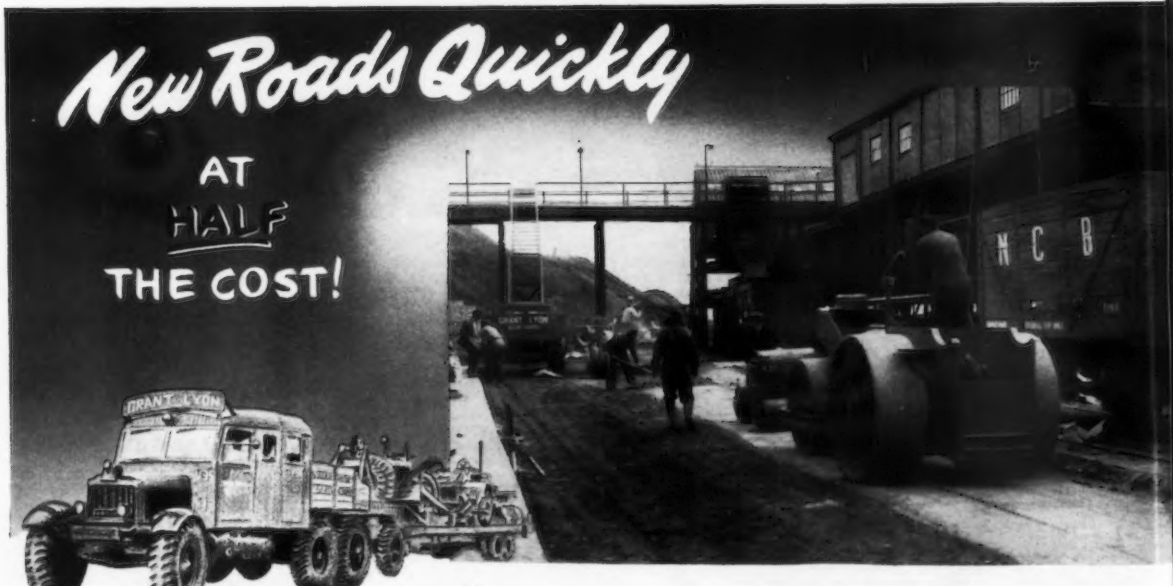

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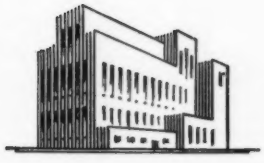

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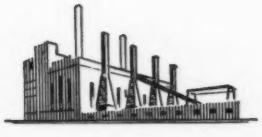

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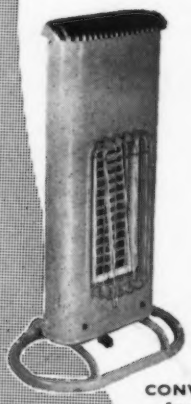

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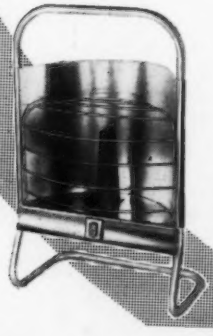

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